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THE APPLICATION OF SIALOGRAPHY IN NON-NEOPLASTIC DISEASES OF THE PAROTID GLAND[1]

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SIALOGRAPHY, the roentgen visualization of the parotid and submaxillary salivary glands after the injection of lipiodol into their respective ducts, has made possible a definite advance in the study of diseases affecting these organs. Prior to the discovery of this method of investigation, the diagnostic measures consisted of manual palpation, exploration of the duct by probe, surgical exploration of the duct and gland, and x-ray examination for opacities. Sialography now enables one to visualize the entire duct system in a manner comparable to a lipiodol study of the bronchial tree.

Many of the diseases arising in the salivary glands produce characteristic changes which are readily demonstrable on the sialogram. The filling defect produced by a mixed tumor is seen as an orderly displacement or distortion of the duct system, while carcinoma may produce irregular filling defects in the duct and gland substance, localized diffusion or puddling of lipiodol, and incomplete filling of the duct system. We have previously described the various changes associated with different neoplastic conditions (7).

In this presentation we are concerned with a study of the changes observed roentgenographically in non-neoplastic diseases of the parotid gland. Thirty-eight such cases have been studied. In each the clinical, the histologic (whenever available), and the roentgenographic findings have been correlated.

TABLE I.—NON-NEOPLASTIC DISEASES OF THE PAROTID STUDIED BY SIALOGRAPHY

Acute and chronic parotitis	15
Post-operative parotitis	1
Extraparotid infections, osteomyelitis and cellulitis	4
Salivary fistulæ	4
Calculosis	2
Stricture of Steno's duct	7
Mikulicz' disease	1
Xerostomia	3
Repair of duct	1
Total	38

TECHNIC

In the present report we shall present only a brief résumé of the technic as a complete detailed description is given elsewhere (7).

The paraphernalia needed for the injection of lipiodol are a 2 c.c. tuberculin syringe and a 20-gauge three-inch needle, the tip of which has been made blunt. A lachrimal dilator or tapered probe and an ordinary blunt fine wire probe complete the necessary apparatus. Lipiodol (40 per cent iodine) is used for the injections.

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It is best to immerse the oil in hot water immediately before using, thereby increasing its fluidity.

The injection is most satisfactorily made with the patient in a sitting position. However, should this position not be feasible and if the duct can be easily located and readily probed, the injection can be performed with the patient lying supine on the x-ray table. As a source of good light we use an electrically illuminated head mirror.

The mucous membranes surrounding the orifice may be anesthetized by a topical application of a 10 per cent solution of cocaine.

The location of the duct orifice is in the papilla of the buccal mucous membrane adjacent to the second upper molar tooth. If the orifice is not visible, gentle massage over the gland and duct will express saliva and thereby disclose its location. Drying the papilla with a cotton applicator or spraying it with air will aid in identifying the point from which the drop of saliva is ejected or expressed. When the above measures fail, gum chewing or sucking a lemon or some similar substance may stimulate a flow of saliva.

After the duct is located, dilatation may be necessary and can be readily accomplished with the lachrimal dilator or tapered probe.

A *B*

Fig. 1-*A*. Normal sialogram, lateral view. The lipiodol is dispersed throughout the finer ramifications of the duct system, rendering a roentgen visualization of the entire duct system.
Fig. 1-*B*. Same patient; anteroposterior projection.

The injection should be carried out slowly and gently, since in adequate amounts the procedure invariably produces some discomfort and pain due to the distention of the ducts. The minimum amount of lipiodol should not be less than 1.00 c.c. and the maximum should not exceed 1.75 c.c. To prevent the escape of the lipiodol after the needle is withdrawn, the patient is requested to compress the orifice of the duct by squeezing the cheek between the thumb and forefinger with gauze.

The roentgenograms may be made on either an upright or a horizontal Potter-Bucky table. Stereoscopic lateral and either single or stereoscopic postero-anterior projections should always be ob-

tained with the head well hyperextended in the lateral view to give better visualization of the retromandibular region.

1. INFLAMMATORY DISEASES

(*A*) *In acute suppurative parotitis* the roentgen appearance is dependent on the degree of changes resulting from the infection. The earliest changes in the major duct system usually consist of a distention or a beading, or both, caused by the presence of thick flaky débris and pus within the major ducts. Early changes in the gland itself consist of small alveolar dilatations, which, when filled with lipiodol, give the appearance of droplets. As an actual breakdown of the glandular structure occurs, cavities form and later these may coalesce to form large cystic dilatations. Recently Feuz (15) has described the syndrome "retro-parotid of Villaret" in which an attack of erysipelas was followed by an acute suppurative parotitis; this later perforated into the external auditory canal. The sialogram in this case showed communicating cystic dilatations throughout the gland parenchyma.

Acute parotitis usually develops as an ascending infection by way of the ducts. The patient complains of swelling in the parotid region, has fever, and is usually in a generally depressed condition. Pus exudes or can be milked from the duct and the duct orifice is swollen and red. The offending organism is usually some type of staphylococci (8).

These infections are generally associated with surgical operations, generalized infections, oral or dental sepsis, and starvation so often associated with acute abdominal conditions.

(*B*) *Chronic recurrent parotitis* is a definite clinical entity in which the roentgen findings are sometimes similar to those observed in the acute cases. Steno's duct is generally dilated and, being filled with non-opaque inspissated material around which lipiodol collects, it presents a beaded appearance as is seen in Figure 2-*B*. The affected portions of the gland are visualized as small spherical collections or droplets of lipiodol simulating the picture seen in bronchiectasis. Frequently the entire gland presents this roentgen appearance. In five of our cases the condition was bilateral. Londe and Pelz (29), reviewing 18 cases from the literature up to 1933, reported that in five the condition was bilateral.

Chronic recurrent parotitis is clinically characterized by a recurrent swelling of the parotid gland associated with a discharge of thick pus or cloudy, flaky saliva from the duct. As the secretions become inspissated, flakes of material or even casts of the duct can sometimes be expressed from the duct orifice. The swelling of the gland usually lasts from three to ten days and in some cases for even longer periods. The swelling may recur at intervals of weeks or months.

The etiology is not always known. Sometimes these swellings occur spontaneously without any apparent reason. Roentgenographically it has been shown that the identical changes are associated with duct calculi, intermittent duct obstruction by tumors and occasionally by stricture. According to Payne (34), these changes are observed with mild degrees of infection of the parotid duct.

Londe and Pelz state that normally various organisms are found in Steno's duct; on the other hand, the smaller ducts and the gland tissue are sterile. Claisse and Dupree (quoted by Kroiss) could not produce inflammation of the salivary gland in dogs by the injection of bacteria, irritants, or foreign bodies into the ducts. Furthermore, experimental obstruction of the duct produces an atrophy of glandular tissue rather than inflammation.

Quite frequently the swelling of the gland occurs after eating. It is possible, therefore, that during mastication minute particles of food, mucoid débris or, in the presence of oral infections, small accumulations of pus are forced into the duct orifice, thereby producing an obstruction. This results in a retention of the parotid secretions and the gland gradually becomes diffusely enlarged. It seems probable, there-

fore, that the bacteria entrapped in such an obstructed duct are in a medium which promotes their multiplication, while in the normal unobstructed duct they are continually washed out of the duct system.

(*C*) In *epidemic parotitis* (mumps), Hobbs, Sneierson, and Faust (22) have demonstrated the typical inflammatory picture on the sialograms.

(*D*) *Miliary abscesses* following strepto-

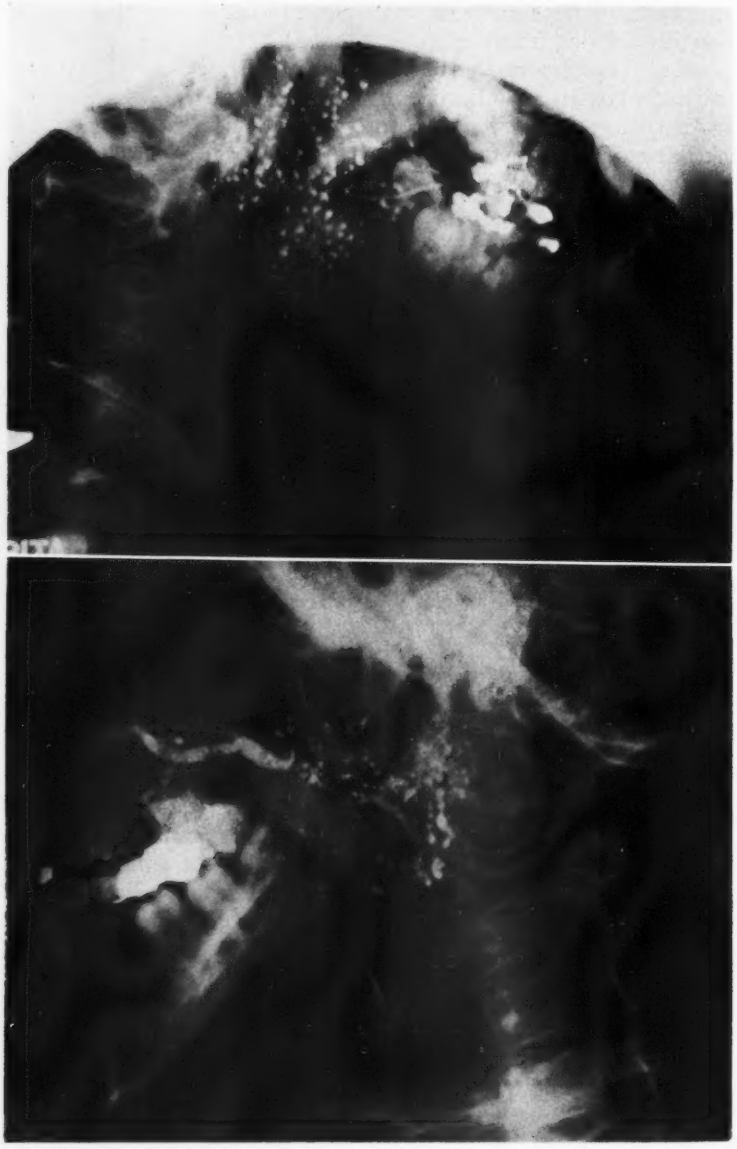

Fig. 2-*A* (*above*). Acute parotitis. The sialogram demonstrates typical droplet formation or cystic dilatations characteristic of this condition.

Fig. 2-*B* (*below*). Chronic recurrent parotitis. Steno's duct is greatly dilated and is filled with non-opaque inspissated material around which lipiodol collects and produces the above beaded appearance. The dilated gland alveoli are represented by the small spherical collections or droplets of lipiodol.

coccus and typhoid septicemias, according to Rocchi (40), give the identical roentgen changes as observed in other inflammatory conditions.

2. OBSTRUCTIONS

Obstructions of Steno's duct are produced by duct calculi, stricture and extrinsic pressure on the duct by tumors or other extra-parotid affections. Each of these conditions is responsible for characteristic changes demonstrable by sialography.

(*A*) *Calculi* in the parotid gland, as in other organs, are not always radiopaque. If, however, their presence is suspected, a roentgenographic examination of the affected parotid region should be made. Unusually small stones may not be visualized on the roentgenograms or they may be superimposed on dense structures and thus fail to be recognized. In some cases calculi can be demonstrated by utilizing a soft tissue technic in the anteroposterior projection. If located in the duct or accessory gland, a very excellent demonstration can be obtained on an oral or dental film. Sialography does not aid in the demonstration of a calculus in the gland; on the other hand, if the calculus is in Steno's duct a filling defect or point of obstruction produced by the calculus is demonstrated by the lipiodol injection. The duct beyond the region of the obstruction is usually greatly dilated. The inflammatory changes associated with the presence of calculi are similar to the roentgen findings observed in other inflammatory conditions. Occasionally these changes are localized to a small portion of the gland. In the case illustrated in Figures 3-*A* and 3-*B*, both glands are extensively involved.

New and Harper (32), analyzing 70 cases of salivary gland calculi, reported an incidence of 92.9 per cent for the submaxillary gland, 4.3 per cent for the parotid gland, and 2.8 per cent for the sublingual gland. Wakeley (44), on the other hand, gave the following percentage of incidence: submaxillary 63.2 per cent, parotid 20.6 per cent, and sublingual 16.2 per cent. Wakeley states that multiple parotid calculi are more common than single, while in each of the three cases reported by New and Harper a single calculus was found. In Noehren's (33) case 14 stones were removed from the parotid duct at one operation. In the two cases of this series multiple stones were found.

The size of salivary calculi may vary from that of a pin-point to one reported by Garretson (16) as measuring one and one-eighth inch in length and two inches in circumference. Orth described a stone weighing 70 grams. The calculi associated with the parotid gland and duct, however, are usually quite small, while those of larger size are usually found in the submaxillary and sublingual glands and ducts.

(*B*) *A stricture or a stenosis of Steno's duct* is generally well demonstrated by means of a lipiodol injection. If a complete stenosis exists, only the patent portion of the duct is visualized. A partial stricture is always clearly demonstrated as a marked narrowing or constriction. The portion of the duct beyond the point of obstruction is dilated. In the case illustrated by Figure 4, three such constricting regions were present; two of these are clearly demonstrated (Fig. 4-*B*) while the third was located near the duct orifice and was discovered when dilatation of the duct was attempted.

In two of the cases in which the duct had been incised for removal of calculi, the duct was found patent for about one and two centimeters, respectively. At these points the stenosis was complete and neither probing nor attempted injection was successful. In each case the parotid gland and also the accessory lobule were definitely palpable as an enlarged, firm, smoothly outlined mass. In these cases, the gland eventually undergoes complete atrophy due to pressure by the retained secretions. As a rule, inflammatory changes are not observed with this type of obstruction.

(*C*) *Pressure on duct by extra-parotid disease* may produce partial or intermittent obstruction. On the sialogram the point of

compression or displacement of the duct is readily demonstrated and in addition to the proximal dilatation of the duct system, localized inflammatory changes may be observed. This roentgen picture may be seen with either infections or tumors located in close proximity to the gland or duct.

We have observed one case in which a small mixed tumor located in the accessory gland compressed the duct in such a way as

Fig. 3-*A* (*above*). Parotid gland calculi. Lateral roentgenogram of the right parotid region showing gland calculi as small rounded opacities in the retromandibular region.

Fig. 3-*B* (*below*). Sialogram (anteroposterior projection) reveals typical inflammatory changes, frequently associated with calculi, involving both parotid glands. The left gland exhibits diffuse cystic dilatations throughout the parenchyma. The right side had been injected a day previously and lipiodol is still present in the "bronchiectatic" or cystic dilatations.

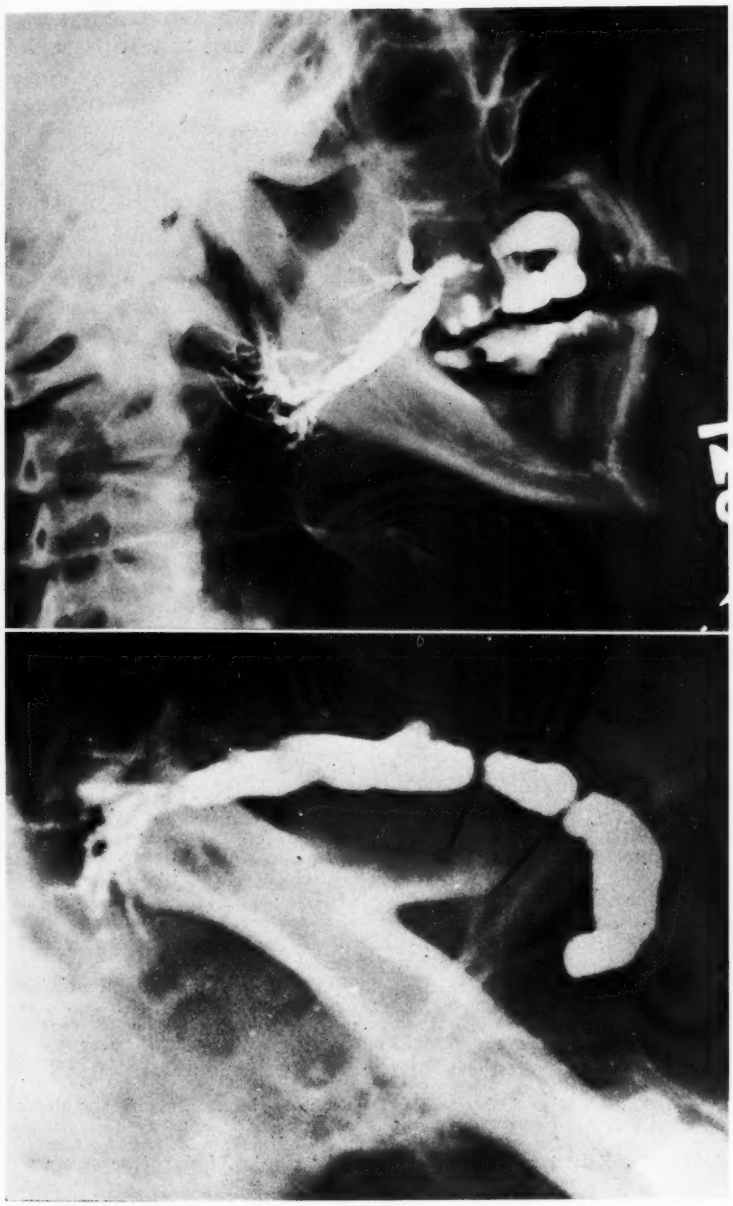

Fig. 4-*A* (*above*). Stricture of Steno's duct. Lateral view demonstrates the marked dilatation of the entire duct system due to the presence of three strictures. Two are shown in Figure 4-*B* and the third, located near the duct orifice, was discovered when dilatation of the duct was attempted.

Fig. 4-*B* (*below*). High vertex projection of the same patient as shown in Figure 4-*A*. Two of the strictures are clearly visualized; one is located at the anterior border of the masseter muscle and the other about one centimeter distal to it. The duct system within the gland is greatly dilated but otherwise appears normal.

to produce an obstruction similar to that observed with stricture of the duct.

Infections, arising either in the soft tissues of the cheek or extending into the soft tissue from a primary focus in the teeth or the mandible, result in swelling which, in turn, may produce certain degrees of obstruction by displacing and compressing a portion of the duct. In these cases, in addition to the displacement of the duct by the swelling, the sialograms demonstrate a normal duct system (Figs. 8-*A* and 8-*B*).

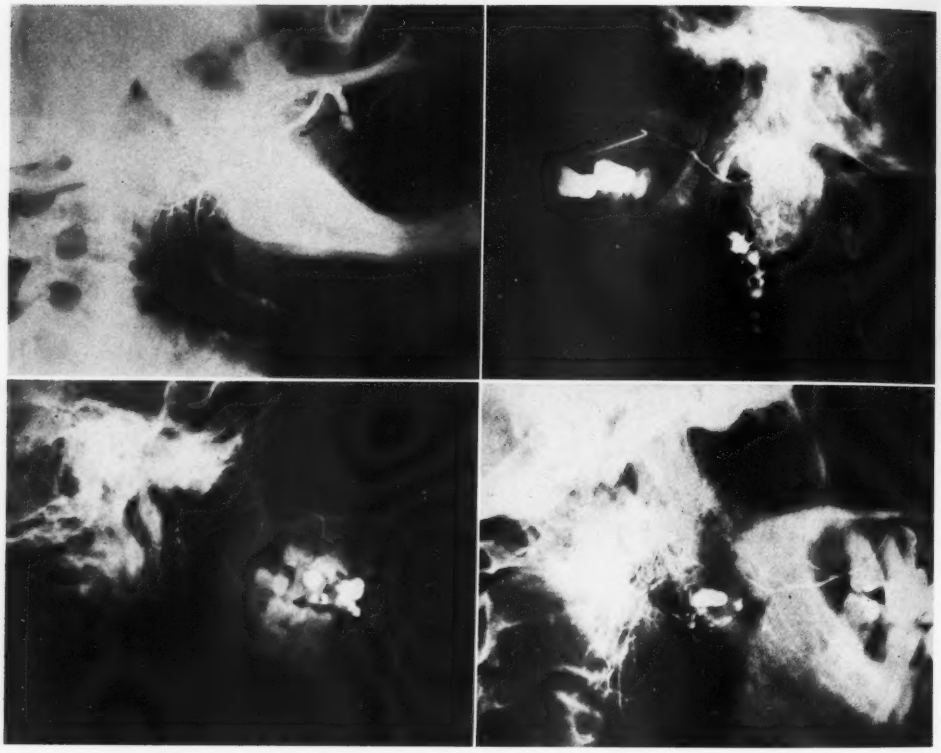

Fig. 5 (*upper left*). Structure of Steno's duct. The major duct system is dilated and a definite constriction near the duct orifice in the buccal portion of the duct is visualized.

Fig. 6-*A* (*upper right*). Parotid gland fistula. Lateral roentgenogram demonstrates a fistulous tract persisting eight days after an incisional biopsy on a mixed salivary tumor.

Fig. 6-*B* (*lower right*). This fistulous tract is the result of a surgical biopsy on an adenocarcinoma of the parotid gland. Aspiration biopsy causes similar traumatic changes. Fistulæ are also associated with infections and injuries. Whenever a biopsy procedure and a sialographic study are contemplated in the same individual, it is essential to have the lipiodol injection done first. The irregular puddling due to the trauma may be superimposed over ducts, obscuring duct detail, and thus may lead to an erroneous roentgen diagnosis.

Fig. 7 (*lower left*). Xerostomia. This condition is characterized by a diminution or absence of salivary secretions, and dry parchment-like oral mucous membranes. The sialograms are characteristic. The entire duct system, and especially Steno's duct, is of a much smaller caliber than normally seen (Fig. 1). In addition, the injection of a minimal amount of lipiodol (1 c.c.) results in diffusion of the opaque medium into the gland parenchyma.

3. FISTULÆ

Parotid fistulæ are readily demonstrated by sialography. The duct system and the point of origin as well as the ramifications of the sinus tract are clearly revealed by the injected lipiodol. In this series four

salivary fistulæ were studied, one following an incision of an abscess of the parotid gland and three following biopsy procedures. In the abscess case the fistula persisted for approximately six months and then spontaneously healed.

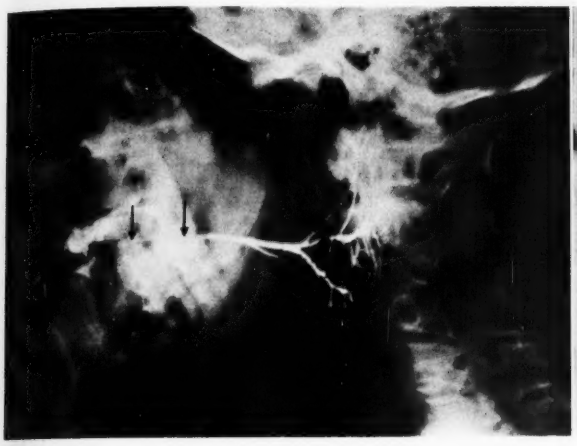

Fig. 8-*A*.

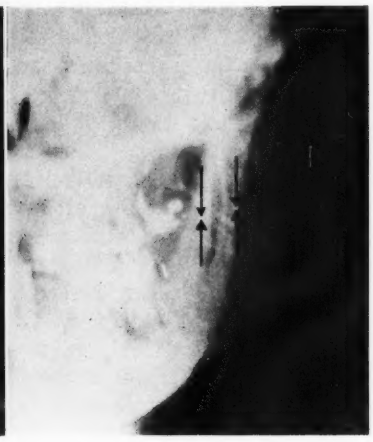

Fig. 8-*B*.

Fig. 8-*A*. Extra-parotid infection. Seven days before admission patient had two molar teeth extracted from left maxilla. Five days later swelling of cheek developed which gradually spread and involved the entire left side of face and cheek. The possibility of post-operative parotitis was considered and for this reason a lipiodol injection was performed. The lateral roentgenogram demonstrates a normal distal duct system. The anterior half of the duct, however, is thinned out, compressed and displaced laterally by the soft tissue swelling in the cheek. Incidentally the cause, an unsuspected osteomyelitis of the mandible arising in an apical tooth abscess, is demonstrated.

Fig. 8-*B*. The lateral roentgenogram shows the marked thinning out and lateral displacement of the anterior half of the duct.

4. XEROSTOMIA

Xerostomia or aptyalism is due to a diminution of the salivary secretions. It may be apparent only during eating or may be so marked that the oral mucous membranes, tongue, and lips are completely dry. The major salivary glands may exhibit no noticeable abnormality or may be palpably enlarged, in which case thick mucus may be expressed from the ducts.

The sialograms in this condition are rather characteristic. The entire duct system, and especially Steno's duct, is of a much smaller caliber than is normally seen (Fig. 7). The injection of a minimal amount of lipiodol (one c.c.) results in diffusion of the opaque media into the gland parenchyma.

In the two cases studied, the mucous membranes were extremely dry, parchment-like in appearance, and the tongue was dry and fissured. The duct orifices were of pin-point size and were identified only after prolonged stimulation of salivary secretions by chewing gum and sucking lemons.

5. MIKULICZ' DISEASE

The typical Mikulicz syndrome has been observed in one individual on whom parotid sialograms were performed. The duct system was found to be of normal size; however, a low threshold tolerance for lipiodol was observed as 1.25 c.c. readily diffused throughout the gland substance.

6. EXTRA-PAROTID DISEASE

In the consideration of treatment it is of great importance to determine whether a lesion arises in the gland itself or whether it is of extra-parotid origin. The extrinsic lesion, either infection or neoplasm, may be in any location adjacent to the gland,

such as the preauricular, mastoid, retromandibular, or submandibular regions.

Infections arising in the soft tissues of the cheek, maxilla, or mandible may extend and involve the parotid area. In the two cases of this series, the infections involved the entire side of the face and cheek. In one case the onset occurred one week after extraction of teeth, while in the other it had been present for a longer period. In both patients there was sufficient evidence to suggest the possibility of a post-operative parotitis. The sialograms demonstrated a normal duct system, thereby definitely establishing an extra-parotid origin of the infection (Figs. 8-*A* and 8-*B*).

As has been previously pointed out, the defect of a mixed tumor or the destructive changes of carcinoma primary in the gland are demonstrated by sialography. On the other hand, extrinsic tumors such as branchiogenic cysts, lymphadenitis, tuberculous lymphadenitis, lipomas, and metastatic cancer in the neck nodes may produce a slight peripheral displacement or distortion of the terminal ramifications of the ducts, thus differentiating this type of defect from that observed with mixed tumors.

7. TRAUMA

Injury to the structures in the neighborhood of the parotid gland or duct may result in a laceration or complete severance of Steno's duct or some of the secondary ducts. A sialographic study in these cases will reveal the extent and the location of the injury to either the duct or gland. Furthermore, the procedure may be used post-operatively to demonstrate the patency of the duct or any post-operative sequelæ such as complete or partial stenosis or chronic inflammatory changes. Recently we performed a sialographic study on a patient in whom a complete severance of the duct had been successfully repaired. The sialograms revealed an entirely normal duct system.

SUMMARY

A sialographic study of 38 cases of various non-neoplastic conditions affecting the parotid gland is presented. The study includes a brief consideration of clinical findings and their correlation to the roentgen findings in the following conditions: (1) inflammatory disease, (2) obstructions, (3) fistulæ, (4) xerostomia, (5) Mikulicz' disease, (6) extra-parotid diseases, and (7) trauma.

The technic of injection is briefly described and the various conditions discussed are illustrated.

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ROENTGEN THERAPY BY THE METHOD OF CHAOUL[1]

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THE purpose of this communication is to present our experiences with the contact roentgen therapy unit which was obtained one and a half years ago through the generosity of Mr. W. H. Donner. Obviously, from such a brief experience, we can draw no definite conclusions, but we can present for your consideration certain physical data and clinical impressions, which, perhaps, may be of assistance to those who are interested in this type of therapy.

Due to technical advances in x-ray tube design, it has become possible to utilize efficiently the lower voltages (45–60 kv.) in radiation therapy. While such low voltages were attainable in the past, safe target-skin distances were so great that skin dosage rates were too low for practical use. At the present time, however, it is feasible, with modern shockproof equipment, to use very short target-skin distances (5 cm. and less), and, thereby, to increase the skin dosage rate to practical values.

High Tension Generator.—Several reports describing the generating equipment of the Chaoul unit have already appeared in the literature (1, 6). Briefly, the x-ray tube is activated by a constant potential generator (Siemens' Monopan), using a modified Greinacher circuit. While the unit includes a constant potential generator, one can employ a pulsating generator of proper capacity to energize the tube.

X-ray Tube.—The x-ray tube is a modification of the Lenard ray tube (Fig. 1). The electron beam passes down a grounded metal cylinder, striking at the end a target of gold-plated nickel. The rays emerge through the target, which, therefore, acts as part of the filtration. In addition, the beam passes through the cooling water (approximately 2 mm.) and a thin metal foil window, which forms part of the water jacket. The total inherent filtration, as stated by the manufacturer, is approximately equivalent to 0.2 mm. of nickel. While the rated capacity of the tube is 60 kv., 4 ma., we chose to operate at 50 kv., 4 ma., to assure ourselves of longer tube life. Factory calibrations were used to determine the settings. When the voltage was later checked with a Behr Generating Voltmeter, we discovered we were really operating at 45 kv.

Since the high tension lead is shockproofed and the anode at ground potential, extremely short distances can be used with impunity. The shortest possible target-skin distance is 3 mm., the thickness of the water jacket. In practice, however, from 3 to 5 cm. distances are generally preferred (Fig. 2), being careful to avoid the water jacket window, which, due to its excessive thinness, is very easily punctured when the applicators are slipped into place.

Water Supply for Cooling.—For adequate cooling of the target, a flow of from 1 to 2 liters of water per minute is necessary. In order to assure this flow, water pressures dangerously close to the rupturing pressure of the foil window must be maintained. The most satisfactory water supply is one with a constant head, such as that obtained with an elevated water tank. Unfortunately, we were not able to place our water tank high enough to assure adequate flow and found it necessary, therefore, to use a reduction valve in the afferent water supply and a pressure relay in the efferent stream. Such a system insures reasonable safety, if the ordinary water supply is used.

[1] Presented before the Fifth International Congress of Radiology, at Chicago, Sept. 13–17, 1937.

PHYSICAL DATA

In view of the low voltage and the short target-skin distances employed, it was expected that the intensity gradients in a phantom would be too large to be followed with an ordinary dosimeter. In order to plot these gradients, Mayneord (7, 8) developed an ionization chamber with a small active volume particularly adapted to this problem (Figs. 3 and 4). Through the generosity of Dr. Mayneord and Mr. W. H. Donner, we were presented with a dosimeter of this type.

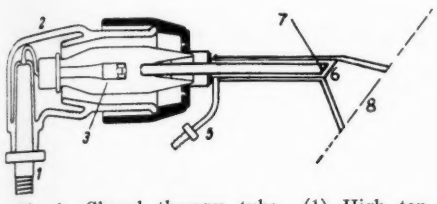

Fig. 1. Chaoul therapy tube. (1) High tension connection; (2) Porcelain housing, protection incorporated; (3) Cathode; (5) Water-cooling lead; (6) Aperture for rays; (7) Focal "spot"; (8) Patient's skin. (*With permission of Mayneord.*)

Dosimeter.—The dosimeter consists of a small ionization chamber (active volume, 3 cubic mm.) connected by a lead to a Lindemann electrometer (Fig. 3). The whole assembly is small and light, mounted on a rack and slide which permits accurate vertical and horizontal motion, to within 0.1 mm., which is ideal for measurements of steep intensity gradients. The lead to the chamber consists of a brass tube which shields the central wire, mounted within amber buttons. Ample provision has been made for the evacuation and immersion of the lead in a water phantom. In spite of the low voltage (45 kv.) with which we worked, it was necessary to evacuate this lead continuously (Cenco Hyvac), in order to minimize the effects of stray ionization in the tube (Fig. 4).

In spite of the high sensitivity of the Lindemann electrometer, it is quite rugged. The needle is viewed by transmitted light, the image being projected through a microscope onto a ground-glass slide. Under action of the roentgen rays, charge is accumulated on the insulated measuring system and the charging rate determined in the usual manner with a stop-watch.

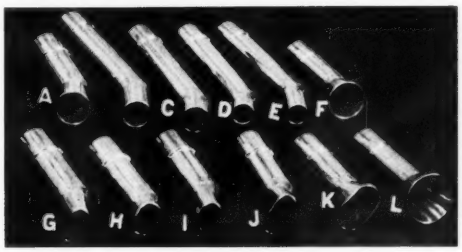

Fig. 2. Applicators supplied by manufacturer.
"A"—5 cm.—3 cm. diam.—102 r/min.
"B"—5 cm.—2.5 cm. " —108 r/min.
"C"—3 cm.—2.5 cm. " —215 r/min.
"D"—3 cm.—2 cm. " —234 r/min.
"E"—5 cm.—2 cm. " —106 r/min.
"F"—5 cm.—4 cm. " —110 r/min.
"G"—5 cm.—3 × 1.3 cm. —111 r/min.
"H"—3 cm.—3 × 2 cm. —243 r/min.
"I"—5 cm.—4 × 1.5 cm. —110 r/min.
"J"—5 cm.—4 × 2 cm. —108 r/min.
"K"—5 cm.—4.5 × 2.5 cm.—110 r/min.
"L"—5 cm.—4.6 cm. diam.— 98 r/min.
All determinations made at 45 kv., 4 ma.

Ernst, Frik, and Ott (6), Chaoul (1, 2), Morison, Hugo, and Mayneord (7, 8) have published excellent papers containing data on the physical characteristics of the rays emitted at 60 kv. by the Chaoul apparatus. Our data concern radiations produced at 45 kv. To facilitate comparison of these data, we have followed, as nearly as possible, the outline of Mayneord's observations (7). The rays were generated at a peak voltage of 45, with a ripple of 4 per cent, current being kept constant at 4 ma.

Intensity of Radiation.—The intensity in r per minute was determined by means of a Siemens' dosimeter with a special low voltage ionization chamber. This instrument was checked several times against a similar instrument standardized by the Bureau of Standards. The dosimeter, equipped with a scale indicating the output in r per minute, was, in our experience, subject to considerable variation. Anyone using such a dosimeter should be aware of

the inaccuracy of its calibration in absolute units. If, however, proper corrective factors are supplied by the Bureau of Standards, such an instrument can be used for absolute measurements.

kv., with a similar filter, the intensity is 61 r per minute at the same target-skin distance.

Measurements were made to determine whether or not small masses of vaseline,

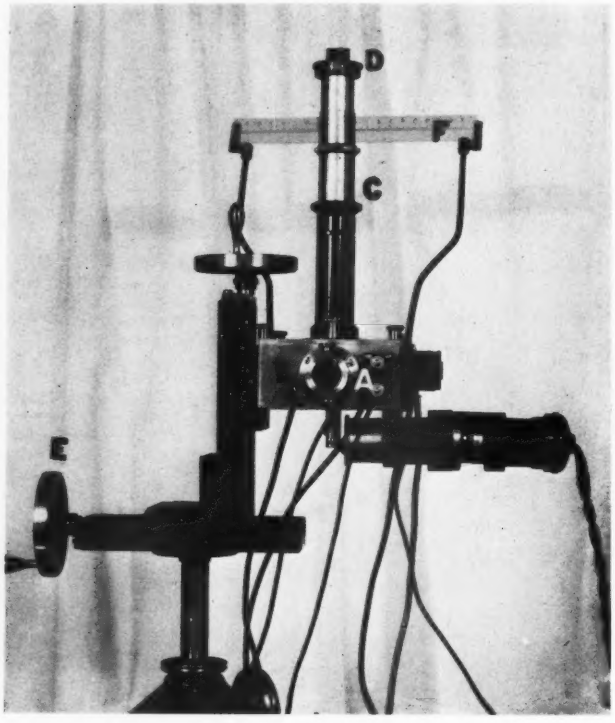

Fig. 3. Mayneord dosimeter. (*A*) Entrance for lead into electrometer; (*B*) Electrometer; (*C*) Telescope; (*D*) Prism; (*E*) Set screws for slide and rack to move electrometer; (*F*) Ground glass rule.

In stating average values of intensity of radiation, one is confronted with large variations in output between x-ray tubes. These variations may be as high as 50 per cent. However, in carefully chosen tubes, we have found the average output to be from 90 to 100 r per minute at 5 cm.; from 200 to 245 r at 3 cm., and an estimated 2,000 r per minute at contact (3 mm.). (See Fig. 12.) It should be emphasized that the high intensities are due to the short distances used. At 50 cm. distance, the intensity is approximately 1 r per minute, whereas at 200

used to lubricate the applicators, would influence the output if interposed in the beam. The results indicated that reasonable quantities of vaseline had negligible effects upon the intensity of the energizing beam.

Quality of Radiation.—The absorption curve is regarded as acceptable for specifying x-ray quality (9, 11). In view of this, we elected to limit ourselves to this method.

Half Value Layer.—The absorption curve was determined in aluminum, since measurements in copper at this voltage

are inaccurate. These data (Fig. 5) reveal the half value layer to be 2.4 mm. aluminum. From the semi-logarithmic curve (Fig. 5), the effective wave length was found to be 0.38 Å. This was calculated from the slope of the straight portion of the curve by means of the formula:

$$\frac{U}{2.7} = 14.45\,3 + 0.15\,(10).$$

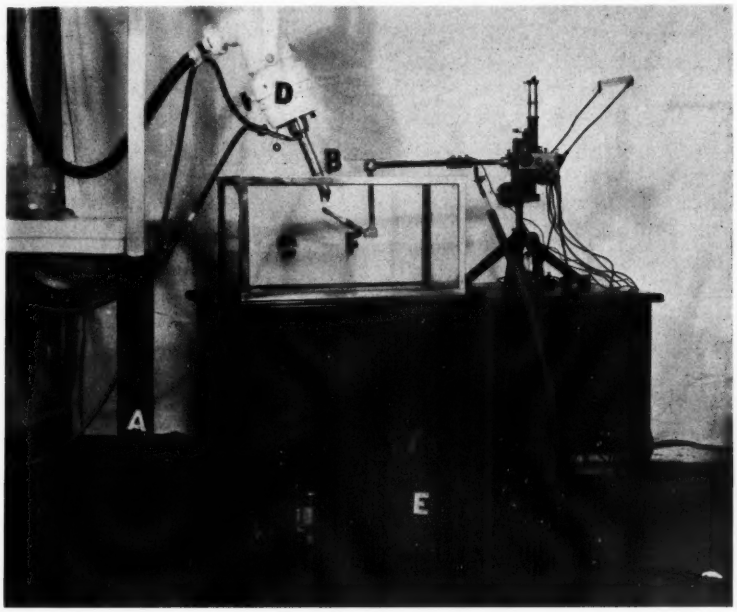

Fig. 4. Apparatus used to determine intensity distributions. (*A*) Stand holding contact tube; (*B*) Anode portion of tube; (*C*) Water phantom; (*D*) Porcelain holder for tube; (*E*) Hyvac pump; (*F*) Ionization chamber and lead to electrometer.

Focal Spot.—Pin-hole photographs of the focal spot revealed it to be approximately 1.6 cm. in diameter. The focal spot picture was made through a pin-hole 0.4 mm. in diameter (Fig. 6). The focal-pin-hole distance was 24 inches (61 cm.); and the pin-hole-film distance, 12 in. (30.5 cm.). The exposure time was 45 minutes at 45 kv., 4 ma.

Radial Variations in Intensity.—The radial variation of intensity was determined in air and in a water phantom (Fig. 7). We found that the intensity falls off toward the periphery of the field (30 to 40 per cent). This may be attributed to various phenomena. Mayneord called attention to the increased filtration as the angle of emergence deviates from 90 degrees. Another concerns the long path of the cathode-ray beam, which makes focusing difficult. In addition, the grounded metal cylinder attracts electrons, which decreases their density in the periphery of the beam.

Variation of Intensity with Distance.—The inverse square law of variation with distance could not be assumed to hold with such a large focal spot at short distances. Our investigations, however, revealed that there was a close agreement between the inverse square law and the experimental results (Fig. 8).

Back-scatter.—The surface back-scatter was determined by first measuring the intensity, in air, in the plane of the end of an applicator. The intensity was then measured at the surface of a water phantom (the chamber being half submerged),

with the same applicator in contact with the surface of the water. This was repeated, using applicators of varying sizes, the target-skin distance (5 cm.) remaining constant. In this manner, the variation of back-scatter with portal area (Fig. 9) was plotted and found to rise rapidly with increases in area, approaching a limiting value of about 20 per cent. Even though the experiments were performed with circular applicators, the results can be applied to portals of other shapes of equal area with a small error. Likewise, these observations for target-skin distance of 5 cm. may be applied to target-skin distance of 3 cm. with a negligible error.

Depth Dose.—The variation of intensity along the central beam was determined in a water phantom (Fig. 10). The percentage depth dose varies from 60 to 25 per cent at 1 cm. depth as the target-skin distance decreases from 5 cm. to 3 mm. The differences in depth dose between the Chaoul unit and a mechanically rectified unit operating at 135 kv., 30 cm. distance, with various filters, are demonstrated in Figure 11. The experiment shows that the intensity decreases more rapidly when using the Chaoul apparatus than with a conventional superficial therapy machine. Isodose curves for three different target-skin distances were determined in a water phantom and are demonstrated in Figures 12, 13, and 14. It is apparent that the intensity distribution in space is symmetrical, with sharply defined edges.

The intensity measurements were made along vertical lines at different distances from the central axis. One typical set of measurements is shown graphically in Figure 15. The isodose contours were obtained by interpolation.

CLINICAL DATA

Although our experience with low voltage and contact therapy has been limited

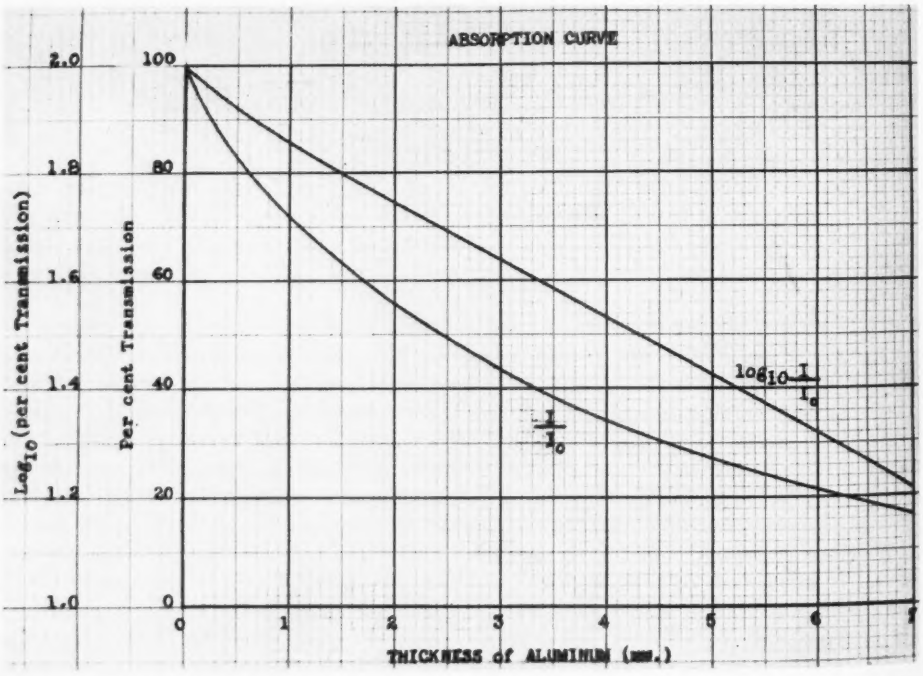

Fig. 5. Absorption curve in aluminum (45 kv., 4 ma.).

to a duration of one and a half years, we feel that certain of our impressions and experiences are worthy of presentation at this time.

Daily Dose and Skin Reaction.—In the treatment of any lesion with the Chaoul unit, the total dose per field is not arbitrarily selected but depends almost entirely upon the reactions of the treated area. The daily dose per field has varied from 100 to 400 r.[2] In some instances, as much as 3,000 r have been delivered at one sitting without injurious results. The erythematous area is always sharply confined to the limits of the applicator. In spite of the radial drop in intensity (Fig. 7), the epidermitis is grossly uniform over the entire treated area. In the majority of cases, from 400 to 450 r, given at one time, produces a threshold erythema. We have given doses as high as 9,000 r, over a period of 25 days, to one portal, with no ill effects.

Our experiences with skin reactions and subsequent repair are similar to those described by Chaoul and Morison (3, 4, 5, 8). As a rule, the skin reaction is almost at its height by the time treatment is discontinued. The severe changes simulate the epidermitis exudativa of Coutard. Doses lower than 3,000 r, if fractionated over a period of about ten days, usually produce the dry type of epidermitis, while still smaller doses produce erythematous changes with slight scaling of the skin. In no instance has the skin failed to heal within three weeks. As yet, we have seen no untoward secondary skin changes, although

[2] All doses in this report are recorded as r measured in air, without back-scatter.

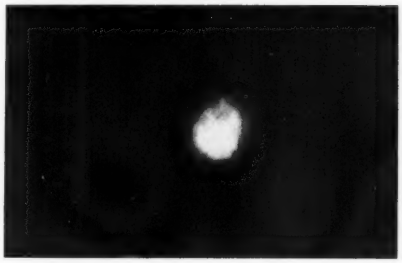

Fig. 6. Focal spot of tube. Taken from roentgenogram.

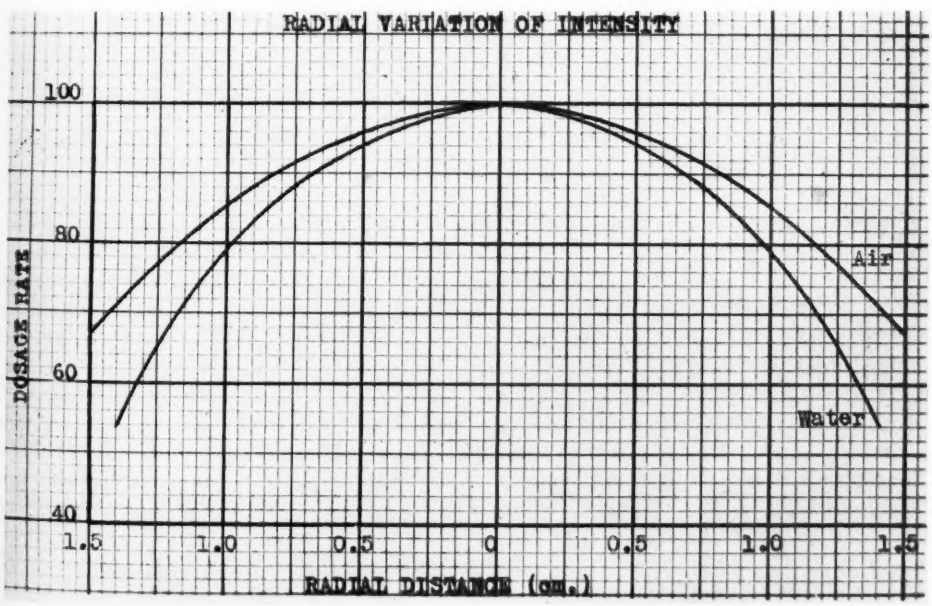

Fig. 7. Radial variation of intensity in air and in water (45 kv., 4 ma.).

sufficient time has not elapsed to exclude such a possibility.

During the past 18 months, we have treated 80 patients. Most of this group were treated for neoplasms, although many parts that might lie in the course of the beam. We usually deliver from 100 to 300 r at one sitting, the target-skin distance varying from 3 mm. to 3 cm. Such doses are repeated at intervals spaced far

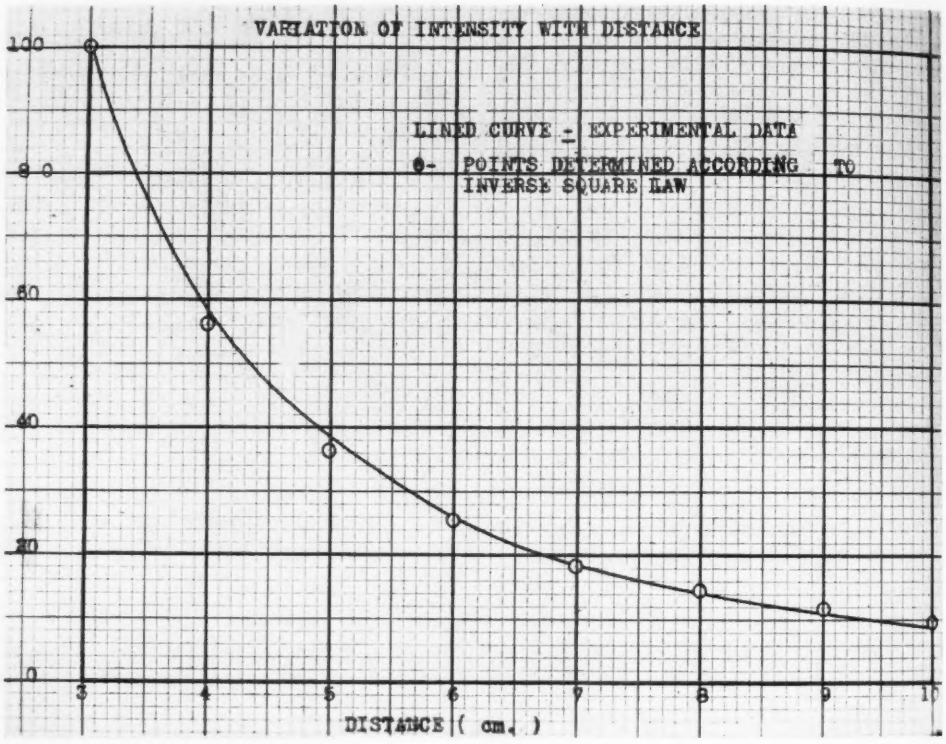

Fig. 8. Variation of intensity with distance to prove application of inverse square law (45 kv., 4 ma.). Ordinates, intensity in arbitrary units; Abscissæ, focal distance in centimeters.

had benign conditions particularly suited to this type of therapy.

Angioma.—The flexibility and high radiation output of the Chaoul unit make it singularly adaptable to the treatment of hemangiomas in infants. The ease with which any portal can be approached and the short exposure time make this type of therapy a welcome adjunct. From a purely physical aspect, the contact method is preferable to other roentgen technics because of the rapidity with which the intensity falls off at depths of from one to two centimeters. Theoretically, this should afford more protection to growing enough apart, six to twelve weeks, to allow one to evaluate the rate of involution, thereby avoiding the sequelæ of excessive radiation. It is obviously impossible to record the total doses necessary for satisfactory results in treating hemangiomas. We should state, however, that some hemangiomas require other types of radiation.

Warts (Verruca Vulgaris).—The concentration of intensity of radiation near the skin surface has made us change our method for treating cutaneous warts. Whereas we once used 135 kv., 30 cm. distance, we are now using the contact

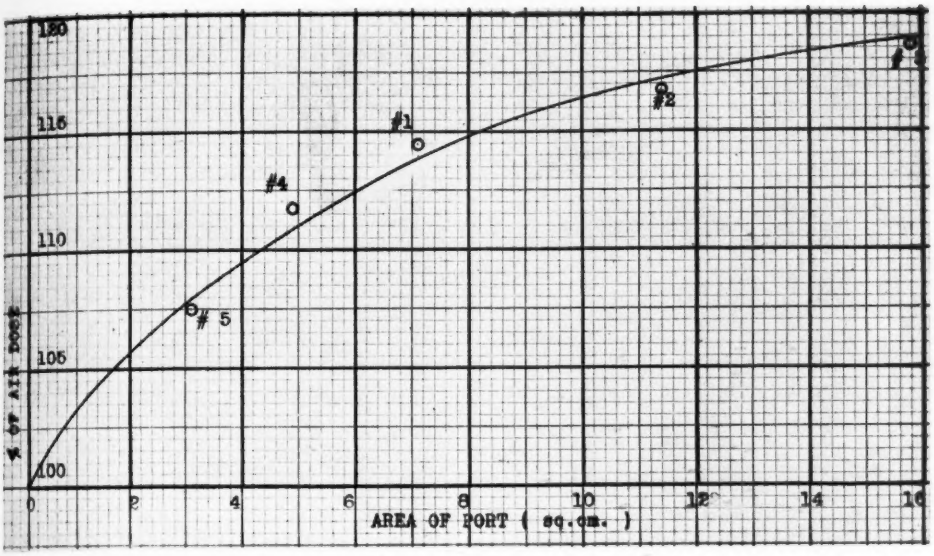

Fig. 9. Variation of intensity of back-scatter with area of port (45 kv., 4 ma.). Ordinates, dosage rate in arbitrary units. Abscissæ, area of port.

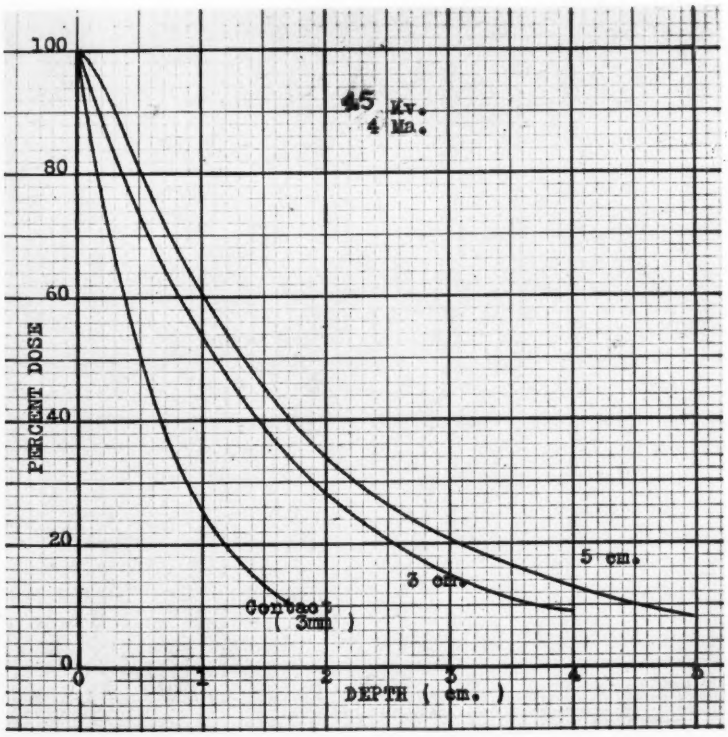

Fig. 10. Variation of intensity along central axis in a water phantom (45 kv., 4 ma.).

method. Since adopting this plan, we are no longer being troubled by the severe reactions produced by exit radiation. It has been our experience that approximately 2,500 r, if delivered in one dose, is sufficient to remove 98 per cent of the warts. This amount of radiation, delivered at 3 mm. target-skin distance, requires less than one minute, whereas formerly it required approximately 25 minutes (1,500 r with unfiltered radiation plus 1,100 r with 1 mm. aluminum).

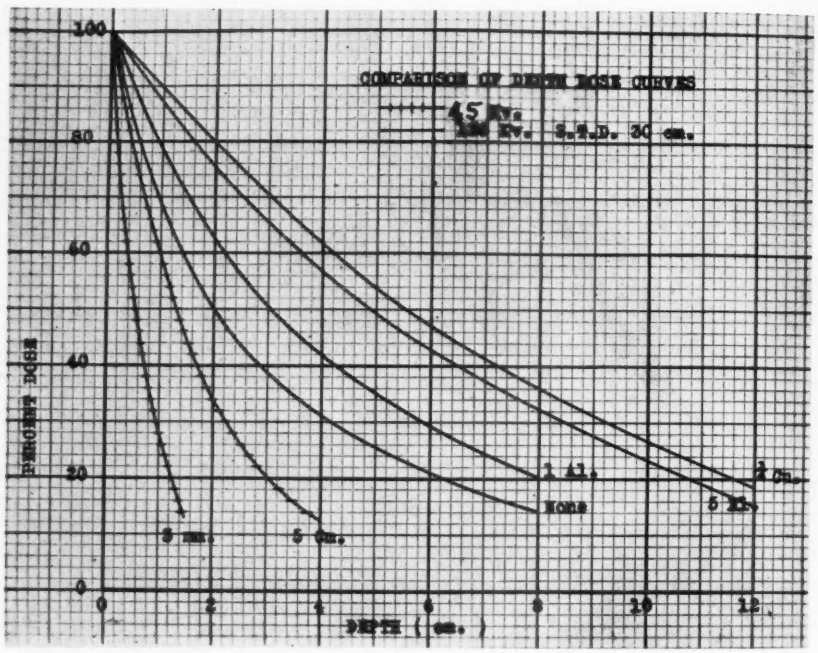

Fig. 11. Variation of intensity along central axis in a water phantom. Comparison of 45 kv. with 135 kv.

Keloids.—For years we have satisfactorily treated keloids, employing the following factors: 135 kv., 30 to 40 cm. total skin distance. This technic has been replaced by contact therapy with results comparable to those obtained at 135 kv. The older method is still used for large keloids, as the greater target-skin distances enable one to include the entire lesion in the one field.

As a rule, rapidly growing keloids in young individuals respond favorably to small doses repeated over a period of time. Usually from 250 to 350 r, repeated at four- to six-week intervals on three or four occasions, suffice. Sometimes, two treatments are adequate, whereas in other patients as many as eight treatments are insufficient. No rule of thumb governs keloids. One must be guided entirely by the individual lesion and its response to radiation, allowing enough time—months—to elapse in order to avoid excessive treatment.

Vernal Catarrh.—Several years ago, one of us (E. P. P., 12) reported the results in the treatment of vernal catarrh by means of radium and radium emanation. At that time, we recommended these agents because they were more easily applied than the roentgen rays. This technic has now been replaced, to a large extent, by contact roentgen therapy, because of the more even distribution of its energy. The ease

with which the target is applied to the eye is equal to the ease with which emanation was utilized.

After anesthetizing the eyes, the lids are everted and plastic lead applied to the eyelashes for protection. A special instrument, used to evert the lid, serves as protection to the globe. Each eye is treated at from 3 to 4 cm. distance, delivering about 250 to 300 r in from one and

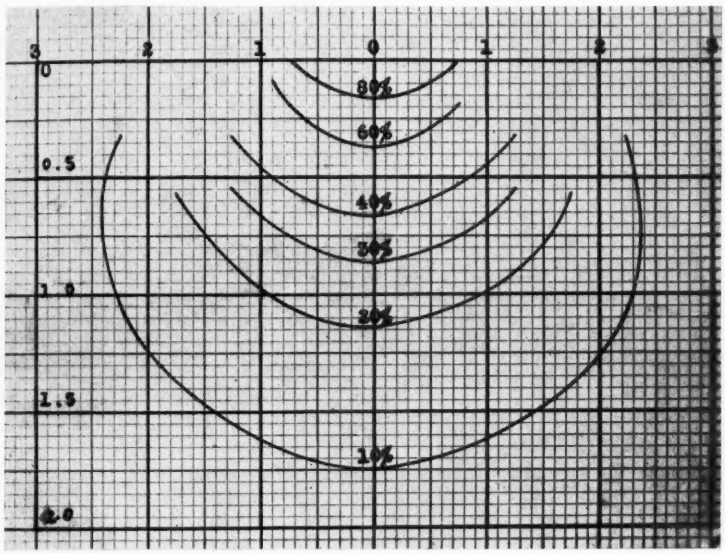

Fig. 12. Isodose contours for contact—3 mm. (45 kv., 4 ma.). Abscissæ, radial distance in centimeters; Ordinates, depth in centimeters.

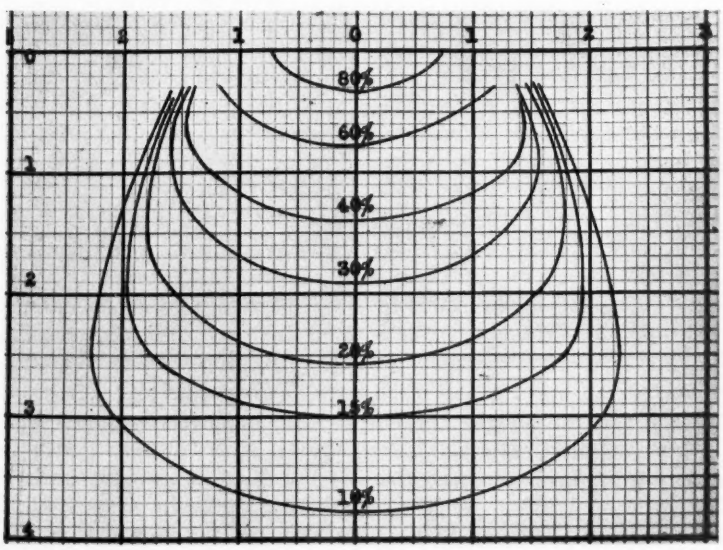

Fig. 13. Isodose contours for 3 cm. T.S.D. Applicator "C" (45 kv., 4 ma.). Abscissæ, radial distance in centimeters; Ordinates, depth in centimeters.

one-half to two minutes. A similar treatment is usually repeated in from four to six weeks, following which several months are allowed to elapse. We have given four such treatments to each eye, over a period of one year, before obtaining the desired results. The limitations and prognosis with Chaoul therapy are similar to those already discussed for radium and emanation.

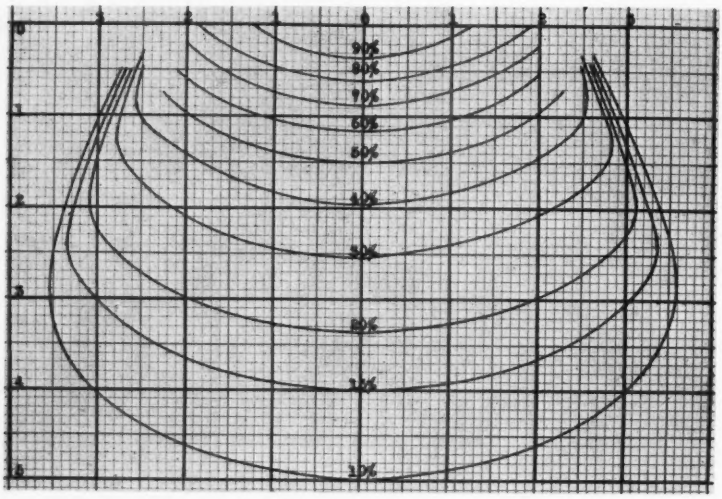

Fig. 14. Isodose contours for 5 cm. T.S.D. Applicator "L" (45 kv., 4 ma.). Abscissæ, radial distance in centimeters; Ordinates, depth in centimeters.

Anal Conditions: Pruritus Ani.—The ease with which the applicator is fitted to the anus recommends its use in this condition. Doses of 200 r, repeated once or twice at twenty-four-hour intervals, are usually sufficient to relieve the itching.

Rectal Condylomas.—Doses of 200 r, repeated daily over a period of from four to five days, are usually sufficient to remove these lesions. As a rule, these warts regress slowly over a period of about four weeks until they are no longer visible. The itching which frequently attends these venereal lesions disappears within the first few days.

Infections.—We have used low voltage therapy successfully in the treatment of small infections all over the body, but nowhere do we use it with more satisfaction than for infections around the eyes, nose, and ears. These areas are particularly suited for the various applicators. Daily doses of from 100 to 200 r usually suffice if repeated once or twice, although somewhat higher doses are necessary in the treatment of axillary infections.

Evidence is now accumulating which points to the small lymphoid tufts scattered irregularly over the nasal and oral pharynx as important foci of infection. The ease with which these areas can be treated through the mouth by means of the low voltage technic may, in the future, be responsible for selecting it as a method of choice.

Malignancy.—Our experience with Chaoul therapy for neoplasms is almost entirely limited to lesions of the skin, lips, and easily accessible portions of the mouth. We have purposely avoided more difficult lesions. As our experience increases, it is our plan to include such lesions elsewhere as may be susceptible to this type of therapeutic approach.

We have treated approximately thirty malignancies, with very satisfactory re-

sults. Failures occurred in two patients whose lesions were far advanced. In these patients, the more superficial portions of the lesions healed, whereas the deeper portions were unaffected. This experience would seem to indicate that deep lesions are not susceptible to this type of therapy alone.

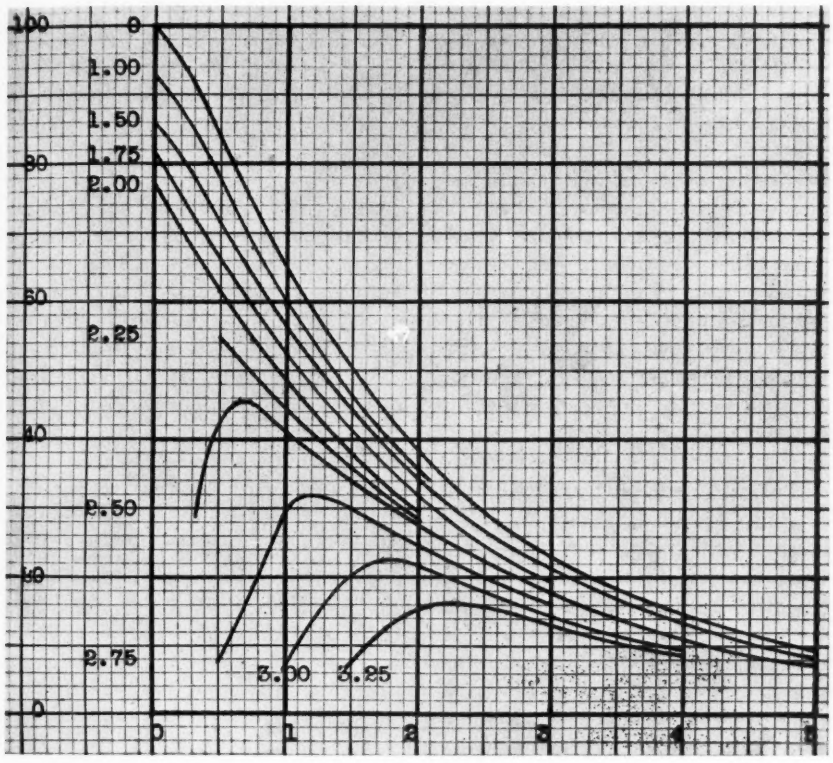

Fig. 15. Variation of intensity along various vertical axes. Applicator "L" (45 kv., 4 ma.). Ordinates, percent dose; Abscissæ, depth in centimeters; Designations on curves, radial distance in centimeters.

Most early superficial cancers may be adequately treated through one portal. The larger lesions, requiring multiple ports, are more difficult because portals must be planned to compensate for the radial drop in intensity. As a rule, each portal receives from 300 to 400 r daily. If multiple portals are employed, each portal is treated daily. Changes in the lesion and healthy skin are usually manifest by the fourth to sixth day. The entire area becomes erythematous and less indurated. The lesion gradually disappears as the total dose approaches 6,000 r. With experience, one can usually tell when enough radiation has been delivered by the "feel" and appearance of the treated area. While from 6,000 to 7,000 r ordinarily suffice, we have given 9,000 r, fractionated over a period of 30 days, before complete regression of the malignancy was obtained.

Lip Cancers.—These lesions may require one or more portals. Each field receives from 300 to 400 r at each sitting. The total dose depends upon one's clinical judgment, as it varies for different tumors. In most instances, from 8,000 to 10,000 r as a total dose has produced complete regression.

We have not been able to use the Chaoul

apparatus for intra-oral carcinomas as freely as one would expect. While the unit is extremely flexible, certain portions of the mouth—the posterior, gingival, and external gingival surfaces—are not easily approached with the applicator. These inaccessible regions are still being treated with radium and high voltage radiation. In some instances, the other portions of the mouth and buccal mucosa are treated with the contact therapy machine. Whenever indicated, interstitial radium, radon, or high voltage external radiation are used to supplement intra-oral applications.

The daily dose is of the same intensity as that delivered for lip and skin cancers. The total dose usually approaches 8,000 r, but here, again, one is governed by the reaction. While patients complain of burning during the height of reaction, the pain is not so diffuse or so severe as with high voltage radiation.

The small size of the applicator makes the use of the Chaoul unit unsatisfactory for the treatment of large lesions. The time taken to treat multiple ports, and the lack of uniformity of radiation in each treated portal, militate against its use in such instances. These large areas are treated best at greater distances, in order to insure more uniform distribution of radiation.

Orbital malignancies are particularly well suited to treatment with the Chaoul unit. The ease with which the eye is approached, and the short time (from one to three minutes) necessary for each treatment, when considered in the light of its energy distribution, make the Chaoul technic preferable to other types of radiation. When necessary, portals can be shaped exactly to fit the lesion, allowing one to use extremely high doses without ill effects. One patient received 8,200 r (portal 1 cm. in diameter), directed into the sclera, over a period of 30 days, without subjective or objective ocular changes. This patient's vision and fundal studies have remained unaffected for over one year.

SUMMARY

Low voltage therapy (Chaoul technic) is indicated as a procedure of choice in lesions so situated that short treatments are desirable.

It is a satisfactory therapeutic procedure in selected cases in which it is desirable to obtain the maximum amount of effect in the superficial tissues.

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CHOLECYSTOGRAPHY: THE SINGLE-DOSE *VERSUS* THE DOUBLE-DOSE METHODS OF ADMINISTERING THE DYE

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IN recent years there has been a tendency to improve the roentgen technic in cholecystography, especially in the dosage of the dye and the time of its administration. It is now generally agreed that the increase in the dosage of tetraiodophenolphthalein has materially improved the density of the gall-bladder shadow. However, there are still some controversial opinions as to how the dye should be administered, whether by the single- or the double-dose method. In order to determine the efficacy of either one of the methods of administration, a series of 200 normal cases were studied: 100 by the single-dose method, and 100 by the double-dose procedure.

In 1926, Morrison and the writer (1) recommended that the maximum dosage of tetraiodophenolphthalein should be given in divided doses to obtain the greatest uniformity of density of the vesicular shadow, as well as to eliminate some of the untoward reactions following its administration. In a more recent communication (2) a minimum dosage of six grams of dye administered in a single dose was advocated, in order to produce uniform gall-bladder shadows of good density and to simplify the mode of administration. Since then, others have recommended the administration of a similar dosage, and some now recommend a larger dose. However, it has been pointed out that the larger dosage is more effective when administered in two doses at different intervals. Thus the so-called double-dose method is now being advocated as one superior to the single-dose procedure.

In 100 cases in which the single-dose method was utilized, a minimum dose of six grams of tetraiodophenolphthalein was administered to those patients weighing up to 160 pounds; nine grams to those weighing from 160 to 200 pounds, and 12 grams to those weighing over 200 pounds. The dye was administered by the technician or roentgenologist, from one to two hours after the ingestion of a cup of tea and two slices of toast.

In the double-dose method, three grams of dye were administered at noon and three grams at 6 P.M. An additional dose of dye was given at 9 P.M. to those weighing over 175 pounds, in order to equalize the dosage factor in the two series.

With the exception of the method of administration of the dye, the technic was carried out similarly in both series. A patient was allowed only water, orange or pineapple juice. If the patient complained of diarrhea or a tendency to loose bowels, two teaspoonsful of paregoric were given immediately following the initial dose of the dye. Otherwise, paregoric need not be given as a routine measure. On the next morning the patient was instructed to drink a glass of water, and to take an enema before coming for the x-ray examination.

This routine study permitted us to obtain accurate information regarding the effects of the different dosages of dye as well as the advantages or disadvantages of the single- or double-dose method of administration.

As a result of this study, it was found that reactions following the administration of the dye by either method did not differ significantly. However, the advantage of the single dose as far as the effects of the dye are concerned, proved, in our experience, to be a more favorable procedure. In the majority of cases there were a few symptoms such as mild nausea; rarely vomiting; and three or four bowel movements. When these symptoms occurred, the patient experienced them only once, whereas if the two doses were given separately, not infrequently there were two periods of reactions—one after each dose. In the double-dose method there may be no reaction at all following the first dose, but it may occur

after the second dose, or *vice versa*. Another disadvantage of the double-dose procedure which is not infrequently experienced, is that if the patient is greatly alarmed by the symptoms following the first dose of dye, the second dose may not be taken for fear of further reactions. On the whole, however, these studies have clearly shown that the occurrence of symptoms in the majority of cases are negligible, regardless of how or when the dye is administered. It has also been shown that the additional amount of dye administered by giving the larger dosage by either method is not as a rule disturbing to the patient.

A comparison of the density of the vesicular shadows was carefully made in each series of cases to determine whether or not the method of administration produced any material difference between the two procedures. An analysis of the 200 cases yielded such similarity of cholecystographic pictures that one can definitely state there to be no noticeable difference in the shadows to warrant the double-dose procedure. This study proved beyond doubt that the single-dose method of administering the dye produces good diagnostic vesicular shadows, in the normal case, in every instance.

It is noteworthy to direct attention to the fact that one of the main features of the double-dose method is that this procedure allows a greater period of absorption of the dye from the intestine. Theoretically, however, this procedure should produce a superior cholecystogram, since probably more of the dye is absorbed from the intestine. Notwithstanding this factor, it has not been proven that more of the dye has actually been absorbed.

Since the diagnostic evaluation of the cholecystographic shadows in the two series of cases were similar, the single-dose method offers the advantage of simplicity.

CONCLUSIONS

1. The diagnostic results following the administration of a large single dose of tetraiodophenolphthalein in cholecystographic studies of the gall bladder do not differ in any way from those of the double-dose method.

2. The single-dose method simplifies the cholecystographic test. The dye is given by the technician or roentgenologist, making certain that the full amount of the dye is administered at a definite time.

3. The double-dose method offers no superior shadows over those obtained by the single-dose procedure.

4. The double-dose method does not prevent or lessen the reactions of the dye upon the digestive tract.

5. The large single-dose method does not as a rule produce any uncertainties in the production of diagnostic vesicular shadows, nor does it require retakes if the technic is carried out properly.

6. The prolonged period of absorption of the dye from the intestine is theoretically of some advantage, but is not necessary, except in cases of extreme diarrhea, for the production of normal vesicular shadows.

7. Regardless of whether the single-dose or the double-dose method is utilized, good results may be secured by either procedure, providing enough of the dye is administered.

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THE INFLUENCE OF ULTRA-VIOLET RAYS ON THE BODY WEIGHT

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THE experiments reported in this paper are meant to be a contribution to the problem of general ray-reaction, the results of which appear to have a theoretical interest as well as a practical one.

METHODS

A total of 141 white mice were used, all of the male sex. There were two series: Series A was abundantly nourished, being fed 32 gm. bread per week—*i.e.*, 8 gm. each Monday and Wednesday and 16 gm. on Friday. Series B was scantily nourished, being fed 16 gm. bread per week—*i.e.*, 4 gm. each Monday and Wednesday and 8 gm. on Friday. Water was supplied to both series *ad libitum*. In Series A, 45 mice were radiated while 34 served as controls. In Series B, 32 mice were irradiated while 34 served as controls.

The radiation took place daily except Thursday and Sunday. As a light source we used the mercury vapor lamp, type S 500 (Hanauer Quarzlampengesellschaft), with the reflector pushed forward. The radiation time varied from five to eight minutes; the distance was 40 centimeters. The mice were kept in a tin box with a wire cover. During radiation the temperature on the bottom of the box was about 38° C.

RESULTS

I. *Determination of the Radiation Dosage.*—The determination of the radiation dosage was made with the aid of a photo-electric cell (zinc cell). With the aid of this cell (1), comparative measurements were carried out between the lamp Type S 300 and the one of the Type S 500 used here. Unpublished experiments have shown that Type S 300 is equal in its intensity to the older type used in our earlier experiments (2) for the determination of the erythema threshold value. For ten parts of the scale on the electrometer, we found the following time averages with diaphragms of 3.5 mm.:

S 500 in 40 cm. distance reflector forward	11.6 sec.
S 300 in 25 cm. distance reflector back	11.3 sec.

Under the above-mentioned conditions these two lamps were, therefore, to be considered as equal in intensity. The required distance was thus determined.

For the determination of radiation time, however, it was furthermore necessary to account for the diminution of the radiation through the wire cover. For this purpose we chose three wire covers and fixed them in front of the diaphragms. Then we measured the time for ten parts of the scale of the electrometer, using the lamp S 500 at 40 cm. distance. Table I gives the time averages received.

TABLE I

S 500 without wire cover	12.2 seconds
S 500 with wire cover A	21.5 seconds
S 500 with wire cover B	22.5 seconds
S 500 with wire cover C	21.8 seconds

Thus it appears that the wire cover diminishes the intensity by about 50 per cent.

Our experience has shown us that with a lamp of the Type S 300 at 25 cm. distance (reflector pushed back) about 100 seconds are sufficient to produce a threshold-erythema of the human skin on the forearm. Now, supposing that the sensibility of the human skin on the inside of the forearm is equal to that of the skin of mice on ears and tail, a dosage of 200 seconds with S 500, under the same conditions as above, should be sufficient to produce such an erythema on mice. However, it appeared that 200 seconds were not enough. Therefore, we began our radiation anew, this time at 40 cm. distance and 300 seconds (5 minutes). After 24 hours this dosage effected in the majority of the mice a weak erythema of the tails and ears, and after a

second radiation, this erythema appeared more clearly.

II. *Influence of the Nutrition and Radiation on the Body Weight.*—Our results on the influence of nutrition and radiation are contained in Figure 1. The ordinate indicates the increase or decrease of the body weight in percentage of the body weight at the beginning of the experiments; the abscissa indicates the time. Table II indicates in parentheses the number of animals from which the weight averages, used in Figure 1, were calculated.

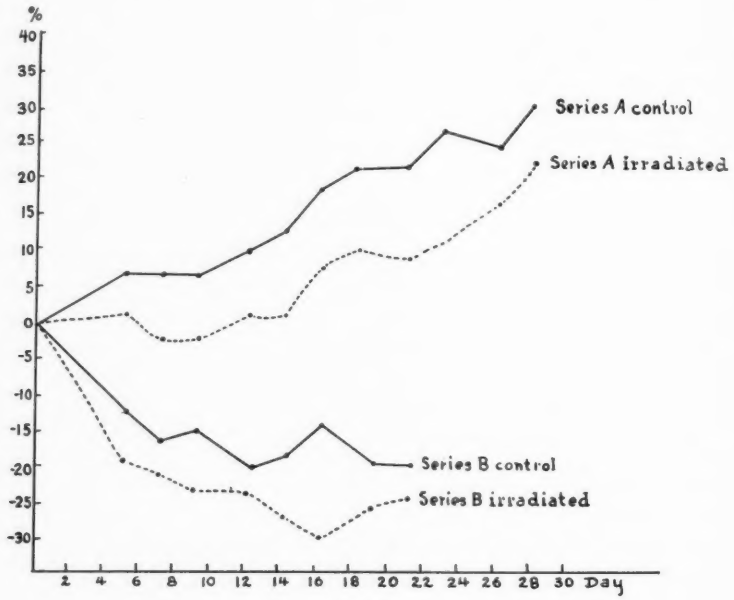

Fig. 1.

As can be seen from Table II, the ultraviolet radiation causes in both series a weight loss which, however, diminishes in both series after about fourteen days, so that the weight curves of the radiated animals approach again that of the non-radiated ones.

It is very interesting to see that this weight loss on the part of the radiated animals is apparently connected with the development of the erythema, as shown in Figure 2. In this experiment by increasing the radiation time from six to eight minutes on the point marked by arrow, we succeeded in stopping once more the rising of the weight curve of the radiated animals.

DISCUSSION OF THE EXPERIMENTS

The weight losses found in our experiments could be explained only by an increase of metabolism and thus directed our attention to the thyroid gland, the increased activity of which might be the cause of this increased metabolism.

Such an increased activity of the thyroid gland as a result of radiation has been found by a number of authors (listed in Laurens, 3, and Ellinger, 4). However,

TABLE II

Day	Series A		Series B	
	Control	Radiated	Control	Radiated
5	+6% (34)	+1% (45)	−13% (34)	−19% (32)
7	+6% (34)	−2% (43)	−16% (34)	−21% (31)
9	+6% (34)	−2% (39)	−15% (22)	−23% (23)
12	+10% (24)	+1% (28)	−20% (31)	−23% (19)
14	+13% (24)	+1% (28)	−18% (30)	−27% (12)
16	+18% (18)	+7% (15)	−14% (14)	−29% (11)
18	+21% (18)	+10% (13)	−19% (19)	−25% (11)
21	+21% (18)	+ 9% (12)	−20% (19)	−24% (10)
23	+27% (18)	+11% (12)		
26	+24% (18)	+16% (9)		
28	+31% (18)	+23% (9)		

there are some experiments the results of which lack such an effect (Mayerson, 5).

In the hope of getting further insight into the state of function of the thyroid gland in our experiments we applied the acetonitril test for thyroid, after Reid Hunt (6), to some of the mice. For this purpose a 2 per cent solution of acetonitril was used for a subcutaneous injection. The solution was prepared fresh each time. The dosage was 1.5 mg./gm. body weight. As a preliminary communication we publish our results in Table III.

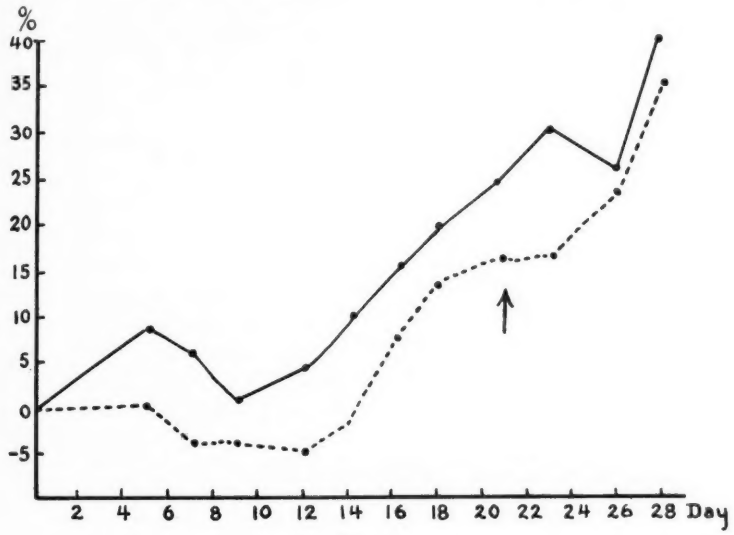

Fig. 2.

TABLE III.—(ACETONITRIL TEST)

Radiation for Days	Dead after 24 Hours: Radiated Animals	Dead after 24 Hours: Controls	Reaction after Reid Hunt
5	6 from 10	2 from 9	negative
10	6 from 10	7 from 10	positive (?)
14	7 from 12	5 from 6	positive
28	6 from 6	6 from 10	negative

Therefore, it seems as if really in the second week the decrease of the weight curve is accompanied by a parallel increase of the activity of the thyroid gland. For the time being, however, we want to report with all reserves, intending to secure them by further systematical research[1]. They seem to us, however, to be quite interesting in connection with our results from the course of the weight curve as well as from other points of view. An increase in the tolerance of radiated white mice toward acetonitril has already been described by Bruman and Blomberg (7). An intimation of such an effect was also described by Riesser and Hadrossek (8). Bruman and Blomberg were able to reach the same findings, concluding that there is an increase in the activity of the thyroid gland as well by ultra-violet rays as by vitamin D doses. They declare, therefore, that formation of vitamin D in the skin is the primary process of this secondary ultra-violet ray reaction on the thyroid gland. We do not agree with this suggestion, and for the following reasons:

It appears from our findings reported above (mainly Fig. 2) that the change in the weight curve apparently is a function of the radiation time and thus influenced by the degree to which the skin is light-accustomed. This seems, in my opinion, to point to the fact that here the formation of histamine-like substances is to be made responsible for this secondary radiation effect. For, if the vitamin D formation were in question, then the photochemical

[1] In the meantime these preliminary results are secured by further experiments as reported in *Acta Radiologica*, **3**, 195, 1938.

formation of the vitamin D in the skin would always have to be the same with the same radiation dosage, because this process must take place in the fatty substances of the skin and must, therefore, be independent of the degree to which the skin is light-accustomed.

The formation of histamine-like substances is, however, dependent on the increasing thickness of the horn-cell layer of the skin under the ultra-violet radiation, depending, therefore, on the degree to which the skin is already light-accustomed.

Thus it seems that our weight curve as well as preliminary results of the acetonitril test of radiated animals offer a new argument for the histamine theory of the ray effects, and at the same time our suggestion that histamine-like substances are playing a decisive rôle could explain the conflicting results of the authors on the outcome of the acetonitril test by radiated mice.

Besides the possibility of the influence of the thyroid gland on the metabolism we must also take in consideration the possible influence of the thyrotropic hormone of the pituitary gland (Paal, 9).

Whatever the explanation of our results might be after further research, the following practical conclusions can already be drawn.

The application of ultra-violet rays and the prevention of a higher degree of becoming light-accustomed, combined with scanty caloric nutrition, might be recommended also for producing a weight decrease in the human body for therapeutical purposes, a proposition which, considering the degree to which the human body is light-accustomed, is easy to be realized.

SUMMARY

A weight decrease in white mice was found after radiation with ultra-violet light under certain conditions of nutrition, and an increase in the activity of thyroid gland was made responsible for these results. This seems to provide an additional basis for the histamine theory of the ray-reaction, and has perhaps some bearing on the treatment of certain kinds of adiposity.

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THE TREATMENT OF CARCINOMA OF THE BREAST

TECHNIC, COMPLICATIONS, AND RESULTS[1]

By ELIZABETH NEWCOMER, M.D., *Denver, Colorado*

THE treatment of cancer of the breast is a complicated problem. For years surgery was the only solution, and a few surgeons still believe it to be the only solution. Most of the surgeons to-day, however, feel that some form of irradiation must be combined with surgery in the treatment of cancer of the breast.

Surgeons divide cancer of the breast into two groups, namely, operable and inoperable; but differ widely as to what constitutes operability.

If the tumor is small and movable, localized within the breast with no palpable axillary nodes, the general method of treatment to-day in a proven case of carcinoma is the radical removal of the breast. A simple mastectomy would probably be sufficient when the cancer is confined to the breast, if it were not for the chance of error in the clinical diagnosis.

In a study of cases by Harrington (6) in which there were no palpable lymph nodes, 29 per cent were found to have metastases at operation. White (12), in his analysis of 195 operable cases, found that 38 per cent had clinical axillary disease, but a careful microscopic examination proved 51 per cent to have axillary metastases.

Radical surgical removal is therefore indicated in all cancers of the breast in this early stage. This must be thorough and should destroy all the cancer-bearing area. Incomplete or careless operation, soiling of tissues during the operation, and carelessness in obtaining a specimen for diagnosis may result in recurrence or metastasis.

The percentage of five-year cures of carcinoma of the breast, when the disease is confined to the breast, varies with different surgeons, but the average taken from available statistics is 70 per cent.

The real problem confronting the surgeon is the curability of cancer of the breast when the axillary nodes are invaded. The percentage of five-year cures drops markedly when the disease is in this stage, and only from 25 to 28 per cent will be alive and well after five years. Portmann (9), in his statistics compiled from reports in the literature, gives the percentages as varying from 15 to 52.1 per cent, the mean average being 28 per cent.

In the late stage of the disease in which there are supraclavicular or distant metastases or recurrences following incomplete surgery, further operation will seldom result in a cure or in the prolongation of the life of the patient. A five-year survival after operation in this stage is very rare.

To recapitulate: With radical surgery, 70 per cent of five-year cures can be obtained if the cancer is confined to the breast, and only 28 per cent if the axillary glands are involved. These percentages have varied but little since the first radical operation was described; therefore, little further improvement can be expected by surgery alone.

The next question then is, can the radiologist produce any additional results in the treatment of cancer of the breast?

The use of x-rays in the treatment of cancer of the breast practically began in 1914 with the advent of the Coolidge tube. In the beginning only low voltage, low dosage, and light filtration were used, and the dosage and methods of treatment had to be devised from experience and from the results obtained. This has been a slow process, technics have been changed from year to year, and no uniform method of roentgen therapy of the breast is used even to-day.

[1] Presented before the Fourth Midsummer Radiological Conference, Aug. 11–13, 1938, at Denver, Colorado.

Portmann (9) says: "As a matter of fact, roentgen therapeutic methods have progressed so rapidly in the last fifteen years, due to improvements in apparatus and knowledge of the physical and biological effects, that it might be justifiable to maintain that radical irradiation as compared with radical operation for carcinoma of the breast did not begin until after 1930. At that time, a technic was developed for protracted irradiation administered in small daily doses according to the growth rate of neoplastic cells until an intensive treatment is given that is known to be effectively carcinolytic."

The results obtained by the early methods of x-ray treatment can, therefore, hardly be compared with the results obtained in the last eight to ten years, as the earlier treatments were not given in the same massive doses as those of to-day.

Radiation Therapy.—There are many problems that arise in the treatment of mammary cancer by radiation.

The radiological problem is to prevent recurrences in the operative field, including the axilla, and to prevent extension to adjacent and distant portions of the body. Sufficient irradiation must be used to destroy or devitalize the malignant cells even at the risk of possible damage to surrounding normal tissues.

According to Crile (4), local recurrences occur in 37.31 per cent. Metastases occur to the lungs in 18.65 per cent; mediastinum, 2.88 per cent; supraclavicular area, 7.88 per cent.

It is obvious that adequate treatment must be applied to the breast, axilla, lung, mediastinum, and supraclavicular area of the affected side if recurrences or metastases are to be prevented.

The technical problem is no mean one. Voltages used by recognized radiologists in the treatment of cancer of the breast vary from 135 kv. to 200 kv. and even higher. Many radiologists use 200 kv. for the axilla and mediastinum, and the lower voltages over the lungs for fear of injuring them. Those using the lower voltages, treating directly over the breast and chest, reason that the lack of penetration of the lower voltages will prevent injury to the lungs and pleura. Following Holfelder and Hintze, many use the tangential method for treating the breast, generally using 200 kv., attempting to deliver a lethal dose to the chest wall without injuring the lung. Of the two methods, the 200 kv. tangential method is the more logical.

Filtration varies from 2 mm. to 6 mm. of Al in the lower voltages, and from 0.5 to 3 mm. of Cu plus Al in the 200 kv. technic.

The distance factor varies from 30 to 40 cm. in the low voltage, to 50 cm. in the 200 kv. technic. Greater distances are generally deemed unnecessary in treating cancer of the breast, but are sometimes used.

Methods of Administration.—There are three important methods of administration, as follows:

1. The intensive single-dose method, which has been largely abandoned.

2. Intensive fractional dose method. This technic, as used by G. E. Richards (10), consists in dividing the total dose to be given into a number of fractions. For convenience, the dose is divided into six fractions, one-sixth of the total dose to be given every 24 hours if the patient tolerates the treatments. He states that "by thus spreading the treatments over six days with 24 hours between each, the time required in radiation minutes to obtain an erythema (600 r) must be increased and an adjustment made accordingly. This adjustment is approximately an addition of 20 per cent."

3. Divided dose method. Pfahler (8), in his Caldwell Lecture, has an excellent description of this method as used by him. He gives both pre- and post-operative x-ray treatments. He uses four portals, except in stout persons, and aims to give 900 r to each portal in the pre-operative treatment over a period of two weeks, using the 200 kv. technic. For the post-operative treatment, he uses 135 kv. over the chest and 200 kv. over the other portals, according to the "saturation technic," being careful not to exceed a full

erythema dose at any time. He aims to deliver from 1,800 to 2,400 r into all the portals, counting both the pre- and post-operative treatments.

Adair (1), in 1935, wrote in regard to the effect of pre-operative irradiation in primary operable cancer of the breast, as follows:

"Our study is based on 117 cases of operable mammary cancer. Each case had (1) positive biopsy; (2) pre-operative irradiation; (3) followed two or three months later by a radical mastectomy, and (4) careful tissue studies. Of this number, 65 cases were treated through five portals by the fractionated dose method, using the 200 kv. roentgen machine, giving 300 r daily to each of two portals. The portals used were one tangential to the breast medially, and one tangential to the breast laterally, thus cross-firing the breast lesion from two directions. The axilla was cross-fired through three ports: (*a*) axilla and supraclavicular anteriorly, (*b*) axilla direct, and (*c*) supraclavicular posteriorly.

"Of the 18 cases treated by roentgen radiation, giving 1,800 r per portal, there was not one instance in which the tumor remained the same size as originally described. Of these 18 cases clinically examined, there was reduction in size or disappearance of the tumor in all cases.

"Of the 36 cases treated by giving 1,200 r per portal, 43 per cent had complete clinical disappearance of axillary nodes. In contrast to this, 18 cases were treated giving 1,800 r per portal. With this treatment, 55 per cent had complete clinical disappearance of the nodes.

"Of the 36 cases treated by 1,200 r per portal, 19 per cent had complete microscopic disappearance of the breast cancer; not clinical disappearance as discussed above. When the dose was increased to 1,800 r per portal (600 r more per portal), the complete microscopic disappearance nearly doubled, namely, 33.3 per cent. In a similar way, the radiation effects went from 14 to 28 per cent. Of the total 65 cases treated by roentgen radiation, in 14, or 21.5 per cent, the tumor disappeared completely from the breast."

From these results we conclude that less than 1,800 r to a portal is insufficient dosage.

Adair, Frazell, and Quimby (2), in 1938, report on another series: "Of the 58 cases receiving x-ray therapy, 57 per cent of the tumors clinically disappeared if they received more than 4 T.E.D. (threshold erythema dose = 500 r in air), while only 34 per cent of the tumors clinically disappeared if less than 4 T.E.D. were given. Doses in excess of 6 T.E.D. are desirable." These figures refer to tumor dose.

The time interval between completion of treatment and operation varied from six to 416 days. Time consumed in giving the treatments was on an average 21 days. These authors state further that the clinical and microscopical findings run closely parallel.

Another problem confronting the radiologist is, shall we attempt the radical irradiation treatment of cancer without surgery in those cases in which the disease is clinically confined to the breast? Considerable work has been done along this line, but the consensus of opinion at the present time is that the radical surgical operation is the method of choice, if the disease is clinically confined to the breast. If irradiation alone is to be relied upon, it must be thorough and complete.

Irradiation Alone.—Keynes (7) has had the most favorable results treating with radium, and his technic, or a modification of it, is generally used in cases in which radium alone is used. He has had 53 per cent of three-year cures.

Roentgen-ray treatment alone has not resulted in any favorable percentage of cures and has not equaled the results in which surgery is combined with irradiation. The improvement in technic and the larger doses over a longer period of time, as are in use to-day, will undoubtedly give higher percentages of five-year cures. Radium combined with x-ray has given better results in cases in which the x-ray treatments have been given before or after the use of radium.

Radiation Therapy Combined with Surgery.—It is generally conceded by surgeons to-day that some form of irradiation should be used in conjunction with surgery, although they do not all agree as to the value of pre-operative radiation.

Webster (11) says: "I am strongly in favor of pre-operative x-ray treatment.

It would seem obvious that a treatment which can cure a considerable proportion of recurrences should help to sterilize the whole field of operation, when it has been given from two to four weeks before operation and the percentage of recurrences should be lessened."

He also states: "As in no given patient can one be sure that operation will not be, or has not been, incomplete, the ideal, where operation is projected, would appear to be association of operation with pre- and post-operative x-ray courses of treatment."

Behan (3) states that the Radiumhemmet of Stockholm found that, in the cases which were irradiated pre-operatively, recurrences were less frequent, and occurred later than in the non-irradiated cases. It is certainly logical, and often the growth regresses during treatment.

The time the patient is operated upon after the x-ray treatment varies with the different surgeons. It can be done in a few days after treatment, or later when the erythema has subsided.

Post-operative Radiation.—For years radiologists where forced to use extensive arguments as to the value of post-operative radiation. The frequency of recurrences after operation, and the results obtained in the treatment of recurrences with roentgen therapy have convinced most clear-thinking surgeons of its value. It is not necessary to advocate its use before a group of radiologists.

In the absence of pre-operative radiation, post-operative radiation should be given as soon as possible, probably in a week. It does not interfere with the healing of the wound. It should be thorough and complete, following the divided dose method, and repeated in from six weeks to two months. As large a dose as can be delivered without injuring the tissues should be given at each treatment. Further irradiation should be given if there are recurrences or metastases.

Treatment of Recurrences and Metastases.—If there have been no previous x-ray treatments, a thorough treatment by some type of the divided dose method should be given, covering the entire chest, front and back, the axilla, and the supraclavicular area on the side involved. If the lungs or liver are involved, it is doubtful if any result will be obtained. In many cases there is an extensive skeletal metastasis without visceral involvement. A persistently painful back should be treated for metastases even if none is seen in the x-ray film, as they undoubtedly occur before they can be shown by the x-ray. Treatment of bony metastases relieves the pain and may result in recalcification of the broken-down areas. We have always treated the axilla and the entire side of the chest involved, both front and back, including the mediastinum and dorsal vertebræ, both pre- and post-operatively if possible. We have never seen metastases occur in the dorsal vertebræ when treated as above.

Since the most frequent skeletal metastases are to the pelvis and lumbar vertebræ, it is logical to give a prophylactic treatment over these areas. We have had marked relief of symptoms, for a time at least, when treatments were given over the skull for cranial involvement.

Radium is of great value for the treatment of localized recurrences.

Castration by Irradiation.—Witherspoon (13) states: "Since 1920, Wintz has used roentgen irradiation of the ovaries as a routine treatment in cases of cancer of the breast. Kaplan, in 1927, recommended castration by irradiation in the treatment of inoperable cancer of the breast, and recently Hoffman observed the disappearance of metastases to the scalp from carcinoma of the breast after roentgen irradiation of the ovaries."

Others have also reported on the favorable results of regression of the metastases from cancer of the breast when the ovaries are irradiated. Castration by radiation during the menstrual life of the patient is certainly logical and is rapidly coming into use, especially in younger women with cancer of the breast. We always try to obtain the patient's consent to treat the ovaries.

Treatment of Inoperable Carcinoma of the Breast.—Carcinoma of the breast should be classified as inoperable when there is a large ulcerating mass in the breast with adherence to the chest wall, or adherent nodules in the axilla with supraclavicular involvement. Films should be taken of the lungs, pelvis, and spine for possible metastases.

Irradiation in some form is indicated in treatment of inoperable cancer. This may cause a shrinkage of the tumor mass so that an operation can be done later, or it may be only palliative. Divided doses of roentgen rays should be given not only over the chest, axilla, and supraclavicular regions, but also to any skeletal metastases. The x-ray treatment will usually relieve the intense pain in the bones and may result in recalcification of the metastatic areas.

These treatments should be given with the 200 kv. technic over a period of three weeks, and repeated in from six to eight weeks if the patient's condition justifies further treatment. We give the treatments even though the patient is markedly cachectic, unless there are metastases to the lungs and abdominal viscera.

Complications of Irradiation.—Dangers of x-ray treatment through the lungs are a pleuropulmonitis and a fibrosis. Downs (5), in a review of 70 necropsies, describes two distinct reactions, as follows:

"1. A pleuropulmonitis, an edematous reaction, which is transient, usually disappearing within a year, if the lungs are otherwise normal.

"2. A fibrosis, which is permanent but rarely occurs unless the lungs are previously made vulnerable by metastasis, chronic disease, or infection."

He also states: "In only one case did we find a fibrosis which we believed to be attributable directly to irradiation."

In spite of Dr. Downs' findings, we think there is a real danger of fibrosis in heavy radiation of the lungs, but believe it is a chance which must be taken.

The acute symptoms due to a pulmonitis clear up in a few months, but some show elevation of the diaphragm and a displacement of the mediastinum toward the treated side which is permanent. We have found that short wave diathermia relieves the acute symptoms promptly.

We have analyzed the results obtained by us since 1926, in the treatment of cancer of the breast. Some of the cases were given pre-operative as well as post-operative x-ray treatments, some were treated for recurrences after operation, and others were inoperable when first seen. Of the patients treated between 1926 and 1931, we have approximately 45 per cent with proven carcinoma of the breast living and well, from seven to twelve years after treatment.

Our method of treatment has changed since 1926, as we are giving larger doses of x-rays in divided doses and repeat the treatments whenever we feel it is necessary. We may cause some damage to the skin and underlying tissues, but feel that the prolongation of the patient's life justifies radical irradiation if there are recurrences or if the disease is inoperable.

We use the following technic: 200 kv. (constant potential), 5 ma., 50 cm. distance, and 1 mm. Cu plus 1 mm. Al for filter. The area to be treated is divided into four or five portals as follows: the first two cover the chest wall anteriorly and posteriorly, including the mediastinum, the lung, and axilla; the third portal through the axilla obliquely; the fourth portal, the supraclavicular region, to one inch below the clavicle. If the patient cannot abduct the arm, we treat through the axilla posteriorly.

One series of treatments is given in from 18 to 20 days in divided doses, alternating the portals. A minimum of 1,200 r is given to each of the portals except the axilla, which receives 900 r. This is in addition to the dose it receives from the first two portals. If the patient has not received a pre-operative treatment, we begin the series within a week after operation if possible, and repeat the same amount in six weeks after the first series is finished. If no involvement was found in the axilla, there

is usually no necessity for further treatments unless we find recurrences when the patient returns for inspection.

If there has been clinical or microscopical involvement in the axilla, a third treatment is given in from eight to twelve weeks later, using the tangential method over the chest wall, and another full treatment in the next six or seven months. We aim to give as much irradiation as the tissues can safely stand in the first year or 18 months. We treat any recurrences thereafter, varying the dose and the portal with the individual patient.

The patient is asked to return for inspection every three or four months, in cases in which there has been axillary involvement, for two years after the operation, as recurrences respond more readily to irradiation if they are discovered early. We have found less recurrences when the patient received both pre- and post-operative treatments.

To illustrate what persistence can do in the treatment of carcinoma of the breast, three cases are cited.

Case 1. A widow, 33 years of age, with no children. Previous history negative except that she had noticed her breasts became very painful and lumpy during her menstrual periods. For about a year before she came for examination, the right breast did not return to normal after menstruation but grew larger. We first saw her in October, 1928, when she had a large tumor in the right breast, which the patient said had been growing very rapidly. She had palpable axillary nodes. A surgeon had examined her, but she refused an operation.

We gave approximately 400 r to the tumor mass, but she refused to take any more treatment because of radiation sickness. She finally submitted to a radical mastectomy in February, 1929. The pathologist's report was adenocarcinoma, very malignant.

This patient returned for treatment in May, 1929, with recurrences in the axilla and supraclavicular region. In one month's time she was given approximately 1,800 r each through the chest and mediastinum, both anteriorly and posteriorly, and to the supraclavicular region. We could not control her radiation sickness, and she refused to return in six weeks.

We did not see her again until the following year, 1930, when she had an ulcerating adherent mass in the axilla, edema of the upper chest wall and supraclavicular region, with involvement both above and below the clavicle. She was cachectic, had lost a great deal of weight, and was very short of breath. She appeared to be in the terminal stage, and we refused to give her any further treatment. Her family as well as the patient herself wished to try further irradiation.

She was given three series of x-ray treatments during 1930. The axilla was treated posteriorly as the patient could not abduct her arm. She received three more series during 1931 and 1932, a total of six series in two years. Much to our surprise, the recurrences disappeared and she gained 14 pounds in weight. She had no metastases to the lungs or skeletal system. A castration dose was given to the ovaries in 1931.

The patient seemed free from the disease during 1933, 1934, and 1935, and no further treatments were given during these years.

In the latter part of 1936, the upper portion of the scar showed an ulcerating area about 2 cm. in diameter, and there were scattered nodules adjacent to the scar. She was given about 300 r to these areas every three months. The nodules disappeared but the ulcerated area would not heal.

In September, 1937, while hanging a picture, three ribs on the right side suddenly fractured. We believe this was due to necrosis of the ribs from too much x-ray as there were no metastatic areas in any other bones. In October, 1937, the patient began to show metastases to the liver and other abdominal organs. She died in December—eight years and ten months after the operation.

This patient received a total of 14,000 r to the front of the chest, and 5,000 r to the chest posteriorly. The supraclavicular re-

gion received a total of 8,500 r, the axilla 4,500 r, in addition to the amount received from the anterior and posterior chest portals. It was interesting to note that this case had no skeletal metastases which may have been due partly to the sterilizing dose given to the ovaries. No metastases occurred in the lungs.

Fig. 1. Case 3. Secondary involvement of the third lumbar vertebra before treatment.

Fig. 2. Case 3. The same vertebra after treatment, showing complete recalcification.

Case 2. A woman, 41 years of age, whose previous history was negative. A lump appeared in the right breast following an injury in 1931. The lump was removed, but no section taken. Eight months later, another lump appeared in the same breast, at which time a radical operation was done. The diagnosis was adenocarcinoma, plus 2 or 3. She was referred for treatment several months later (in September, 1932) with recurrent nodules in the axilla. She was given two series of treatments, six weeks apart, over the chest front and back, supraclavicular region and axilla. She was given divided doses of x-ray, each portal receiving 1,740 r during each series.

This patient returned early in 1933, at which time 1,300 r over the anterior chest portal and 1,000 r to the axilla were given, as the nodules had not disappeared. When she returned in six months, she had a marked fibrosis of the lung and no further treatment could be given over the chest. She was, however, given further treatments in the next three years through the axilla and the upper portion of the scar, as these areas were very resistant to radiation. She received a total of 4,780 r to the front of the chest, 3,480 r to the supraclavicular region and back of chest in six months' time, and 10,000 r to the axilla and upper portion of the scar during the five years.

We examined her in June of this year. There were no recurrences or metastases present; the patient felt well and had gained weight. She can do her own housework but is short of breath on exertion. The fibrosis is not as marked, but the heart and mediastinum are held over to the right, and the right leaf of the diaphragm is ele-

vated. She appears to be well six years after treatment.

Case 3. This patient is under treatment at the present time. She is a widow, 48 years of age, and the mother of one child. This patient states that she had noticed a small lump, just external to the right breast, in 1927. The nipple was retracted and she could feel small lumps in the axilla. The breast began to get hard and she could feel a string of glands along the anterior axillary border. She went to a layman, who applied "salve" over the entire breast area, in 1932, and again in 1933. This destroyed a great deal of tissue, but the ulcerating mass finally healed. She was referred to us for treatment in 1934.

Fig. 3. Case 3. Shows a secondary malignancy of the ilium and head of femur.

Fig. 4. Case 3. Shows the same area after treatment with complete recalcification.

At this time she was suffering intense pain in the lower back and left hip and ilium. She could not lift her legs, necessitating the use of crutches. She had to be lifted on and off the treatment table and was unable to turn herself. She had lost a great deal of weight and was markedly cachectic. Upon examination, we found the nipple of the right breast drawn upward and outward, an ulcerating mass over the right breast area (most of the breast tissue having been destroyed), and a large ulcerating mass in the axilla. Films were taken of the pelvis and back. Multiple metastases were found in the left hip and ilium, and a partial destruction of the third lumbar vertebra. There were no other skeletal metastases, nor any in the lungs.

She was given treatments over the pelvis and lumbar vertebræ which gradually relieved the pain. She also received a full series of x-rays over the chest wall, axilla and supraclavicular areas. The treatment over the pelvis stopped her menstruation. She was able to walk without crutches by April, 1935.

In order to protect her lung as much as possible, an area internal to a line from the nipple downward was given one-half

the irradiation that the area external to this line received.

Late in 1937, the patient complained of severe pain and a feeling of crunching in the cervical vertebræ. An x-ray film showed some changes in the lower four cervical vertebræ, but we could not say definitely that the changes were due to metastases, although there had been no such changes at our previous examination.

We irradiated the cervical vertebræ, and she wore a cast for nearly three months. She had no further pain or trouble in this area after the cast was removed. About a month ago, the patient had chains of small nodules running downward and inward from the nipple toward the sternum. This was the area that had received less irradiation than the area external to the nipple.

At the present time, there is a small tumor in the left breast just below the nipple, and this nipple is beginning to retract. We are now giving her treatments over the left breast. This patient has gained 25 pounds in weight, is able to walk without difficulty or pain, and is working for a living. The left hip, ilium, and third lumbar vertebra have recalcified and there are no other metastases shown.

The following dosage was applied to the different portals since she came under our care in 1934: entire pelvis, 2,800 r; left side of pelvis, 5,000 r; lumbar vertebræ, 2,000 r, and cervical vertebræ, 2,600 r. The right chest anteriorly, 4,000 r; posteriorly, 3,000 r. The supraclavicular area, 1,800 r, and the axilla through two portals, 2,550 r. An area external to the nipple on the anterior part of the chest received an additional 4,000 r.

It is interesting to note that no metastases occurred to the lungs or dorsal vertebræ in any of the three cases that were treated as above, nor have we found them in any of the cases that were given large doses of x-rays through the chest and lungs.

CONCLUSIONS

The only methods to-day for treatment of carcinoma of the breast are surgery, radium, and roentgen rays. The combination of these methods has more than doubled the percentage of five-year cures.

We believe that the attitude in cancer of the breast would not be so pessimistic if all cases were given both pre-operative and post-operative irradiation covering the mediastinum, lung, axillary and supraclavicular regions, and if a third series of treatments were given within another twelve weeks.

The patient should be inspected every three or four months for a period of two years after operation, and thereafter at least once or twice a year. Treatment should be given whenever it is necessary.

In cases in which no pre-operative irradiation has been given, the patient should be irradiated as soon after operation as possible, followed by two more series in from six to twelve weeks.

No patient should be considered to have received proper irradiation who has not had at least two series of treatments with a minimum of 1,800 r per series to the affected side, including the supraclavicular area with considerably more to the axilla. This applies especially to cases that have had clinical axillary involvement. A third series is advisable.

Persistent treatment of recurrences and skeletal metastases will often extend the life, usefulness, and comfort of the patient for many years.

A sterilizing dose of x-ray should be given to the ovaries in all young women who have cancer of the breast.

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PARAPLEGIA FROM EROSION OF VERTEBRAL COLUMN BY LARGE THORACIC ANEURYSM

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EROSION of vertebræ by thoracic and more particularly by abdominal aneurysms of the aorta is a rather frequent occurrence, but cases in which that erosion proceeds far enough to cause spinal cord symptoms by compression seem to have made a rather diminutive percentage of the total cases reported.

Recently the subject of cord compression in aneurysm has been dealt with by Ponde and Fialho (10) and by Fumarola (3). One hundred cases of aneurysm of the aorta were analyzed by Brindley and Schwab (15), who found 2 per cent of them in the descending thoracic aorta. Lucke and Rea (7) found five thoracic aneurysms in 263 cases of aortic aneurysm.

Putts and Bacon (11) point out that Vesalius, in the year 1555, recorded a case in which marked pain in the back had been the dominant feature, and which at autopsy disclosed a thoracic aneurysm with erosion of vertebræ.

The reason erosion so seldom goes to the point of actual exposure of the cord with compression would seem rather obvious: the aneurysm ruptures before such extensive bony destruction can take place.

Some of the largest aneurysms have relatively thin walls. Much depends, of course, upon the type and extent of thrombus formation within the aneurysm. Some aneurysms have a fibrous wall of such character that little upgrowth of granulation tissue into the mural thrombus appears, and the lower layers become quite compact (8). In such cases the wall of the sac may contain considerable amounts of calcium.

Thoracic aneurysms are ordinarily situated only a few centimeters above the diaphragm (5), and are rather definitely of the sacculated type (1). They are more frequent in men (4) with an age range of from 35 to 60 years. The dominant symptom is frequently pain, and in typical cases spinal rigidity and obliteration of lumbar lordosis usually appear, with aggravation of pain on movement.

When erosion does progress to an advanced degree, the centers of the vertebræ are destroyed down to the spinal canal, leaving the yielding intervertebral disks standing (8): further destruction will involve the disks, but this is less frequent than bony destruction alone.

The lack of gibbus formation in so many cases has led to considerable discussion (9). Schanz (14) points out that gibbosity is in many cases doubtless prevented by the resistance of the aneurysm itself against the spine.

Cases have been reported with a duration of seven years (12); however, Reifenstein and Allen quote Cabot (*ibid.*) to the effect that most cases terminate within two years from the time that symptoms become definite.

Diagnosis of thoracic aneurysm is apt to be rather elusive, unless the physician is led to it by the complaint of intractable pain in the back, in which case the roentgenogram makes the state of affairs plain. Aneurysms in all portions of the aorta, for that matter, are more apt to come to correct diagnosis through some routine roentgenogram than in any other manner (6).

In the case to be described, the patient, E. D., a colored female, 47 years of age, married, gave a definite history of syphilis. She stated that she had had several Wassermann tests made, and that the first had been "two plus" but that succeeding tests had been "negative."

Her symptoms dated back to January of 1936. At that time she began to complain of pain in both legs, followed by weakness. By April of 1936, she had become unable to walk. Then followed a period of remissions and exacerbations of the symptoms relating to her legs. She regained the power to walk after a few

months, lost it again, and twice more regained and lost it. She became bedfast a few months before her admission to Cook

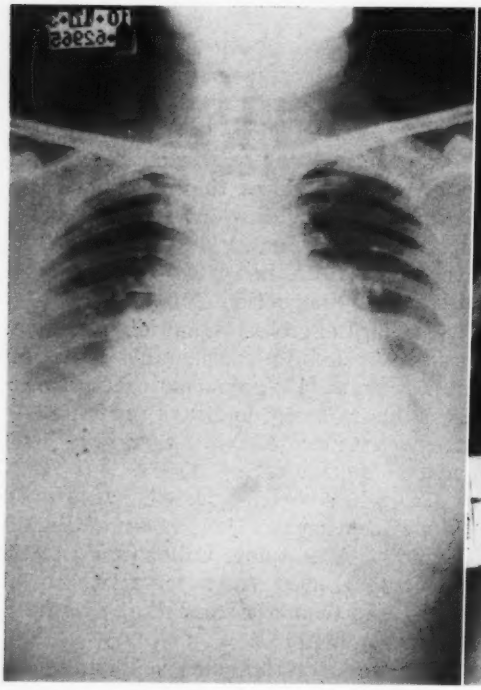

Fig. 1. Postero-anterior chest.

Fig. 2. Anteroposterior projection of dorsal spine.

County Hospital, which was in October, 1938.

There, on a neurologic service, the history taken revealed nothing of any consequence, in addition to the points just enumerated, except gradually increasing dyspnea.

The general physical examination revealed a blood pressure of 262/170, with considerable left-sided increase in the heart's diameter.

Neurological examination revealed the following: the tendinous reflexes in the upper part of the body, including both upper extremities, were essentially normal, and the cranial nerves showed no abnormalities aside from the finding of an Argyll Robertson pupil.

The pathologic findings were, in the lower extremities: the right leg showed a flaccid paralysis, and the left a spastic one; there was, in other words, a complete paraplegia—this being determined to be from the level of D6 with a complete sensory loss from the same level. While in the ward the patient complained of dyspnea, worse when she was constipated, and relieved by enemas.

The blood Wassermann was negative. The spinal Wassermann was four plus, with other findings as follows: xanthochromatosis; globulin present by Pandy test, three plus; pressure (base, 30; on straining, 40; right jugular, 38; left jugular, 35; both jugulars, 38); cells (50 lymphocytes, 200 red blood cells).

Despite the positive spinal fluid serology, the level of sensory and motor loss was so sharp that a tentative diagnosis of spinal cord tumor was made, and routine

roentgenograms of the chest and dorsal spine were ordered.

It was noted that the patient had not complained of pain in the back. Any pain mentioned had been referred to the lower extremities.

The chest roentgenogram revealed some distortion of a large heart shadow: there was a second outline superimposed, but not with such distinctness as to warrant the expression of an opinion.

The anteroposterior and lateral views of the dorsal spine revealed a large saccular out-pouching of the descending thoracic aorta, bordered by a thick rim of calcific density, resting upon the bodies of thoracic vertebræ four to eight, and having deeply eroded those vertebræ, especially the sixth and seventh. This finding seemed to offer much toward the diagnosis of cord compression.

Two days after the films were made, the patient experienced a sudden increase in the dyspnea of which she had previously complained. She sank rapidly, the blood pressure falling from 262 systolic to 140 systolic within a few hours, and she died the same day.

The autopsy findings relating to the subject of this paper are reproduced here *verbatim*, after the preliminary observation that the cause of death appeared to be cardiac failure and dilatation. There were no unusual findings in the brain and the aneurysm was not ruptured.

"Vertebral column: The anterior portions of the bodies of the fourth, fifth, sixth, seventh, and part of the eighth thoracic vertebræ are missing. The edges are eroded by the large, adherent aneurysmal sac, and on removing the sac the dura of the spinal cord is exposed in the region of the sixth and seventh thoracic vertebræ for a distance of 25 mm.

"The heart weighs 380 gm., the myocardium is firm, purple-red, the left ventricle measuring 20 mm., the right 4 mm.; the valves unchanged; pulmonary artery 81 mm., the aorta 80 mm. Just above the middle leaflet there is a 20 mm. path of longitudinal wrinkling. The intima of the arch contains some hyaline plaques. The coronaries' walls are thickened and the intima contains many fatty plaques.

Fig. 3. Lateral projection.

"Aorta: Beginning from the first portion of the descending thoracic aorta the intima shows a fine wrinkling and contains numerous hyaline, fatty, and calcific plaques. Five centimeters below the arch the posterior wall presents a large defect 5 cm. in the vertical diameter and 3 cm. in transverse diameter. The defect extends into a large sac, 16 cm. in transverse diameter, 10 cm. in vertical diameter. The wall of the sac is partially calcified and fuses posteriorly with the vertebral column. The lumen of the sac is filled with laminated yellowish brown and reddish brown blood clots. On the anterior surface there are more recent purple-red blood clots."

SUMMARY

A case of aneurysm of the descending thoracic aorta is described, having the following unusual features:

1. Erosion of the thoracic vertebræ had proceeded to the point where the cord membranes were exposed for a distance of over 2 cm. and the resulting compression had produced a paraplegia from the level of the sixth dorsal vertebra.

2. Despite the extensive destruction of vertebræ, and in sharp contradistinction to most similar cases reported, the patient had never experienced pain in the back.

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THE PULMONARY ARTERY[1]

A ROENTGENOGRAPHIC AND ROENTGEN KYMOGRAPHIC STUDY

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"As a rule, pulmonary artery disease is a postmortem finding, not diagnosed or diagnosable during life." So states Paul D. White (1). In the light of our experience we cannot concur with this view unless the author refers to clinical and physical examinations alone. We believe with many roentgenologists that the x-ray method has advanced our knowledge of the lesser circulation and that a diagnosis of pulmonary artery disease can frequently be made during life. As a matter of fact, the lesser circulation is more accessible to investigation than the systemic, being entirely confined to the lungs, a region which is readily studied by the x-ray.

Our own interest in diseases of the pulmonary artery extends over a number of years, during which time we have accumulated a large collection of roentgenograms representing various lesions of the vessels of the lesser circulation. Some of the cases under our observation came to necropsy, thus enhancing the value of our material. More recently we have been able to use the roentgen kymographic method in the study of the heart and great vessels. The result of our observations is the basis of this paper.

Roentgen Anatomy of Pulmonary Conus and its Main Branches.—The anatomy of the pulmonary conus and its main branches is described by Cunningham (2) as follows: The conus or main trunk is about two inches in length and nearly one inch in diameter. It commences at the upper end of the infundibulum and runs backward and upward into the concavity of the aortic arch, where it bifurcates to form the right and left pulmonary arteries.

Roentgenologically the pulmonary trunk is a part of the great blood vessel shadow occupying approximately the left third of the shadow, the ascending aorta and vena cava superior, the middle and right thirds, respectively. In order to obtain a fairly accurate perspective of the conus and its branches the x-ray study includes all the four standard chest positions, namely, anterior, lateral, left and right obliques.

In the anterior position (Fig. 1-*A*) the left boundary of the conus is situated between the aortic knob and left auricular appendix. It varies in length, being longer in the vertical type of heart and shorter in the transverse, while its contour may be straight in the sthenic individual or slightly convex in the asthenic. In children the conus is usually more prominent. The right boundary of the conus cannot be differentiated from the adjoining structure, the ascending aorta, as the shadows are fused.

In the lateral position (Fig. 1-*B*) the conus is seen to extend upward and backward parallel to the aortic arch. Its anterior and upper boundary is clearly outlined, especially in cases of moderate pulmonary emphysema (as it is in this illustration). Its lower boundary cannot be distinguished from its origin, the right ventricle. At the termination of the conus there is a dense oval-shaped shadow due to the cross-section of the right pulmonary artery, indicating the bifurcation of the conus into its two main branches. The left pulmonary artery continues backward and downward before it enters the left lung. Below the left pulmonary artery a ring-like transparent shadow is often seen, due to the cross-section of a major bronchus.

The relationship existing between the

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trachea, bronchi, aortic arch, and pulmonary arteries is best shown in the following illustrations. In the anterior view (Fig. 2-*A*) the trachea lies to the right of the aortic arch, below which it bifurcates. The right bronchus continues downward and slightly outward in a straight course. The left bronchus deviates to the left in its passage through the aortic loop. Between the aortic arch and left bronchus there is a

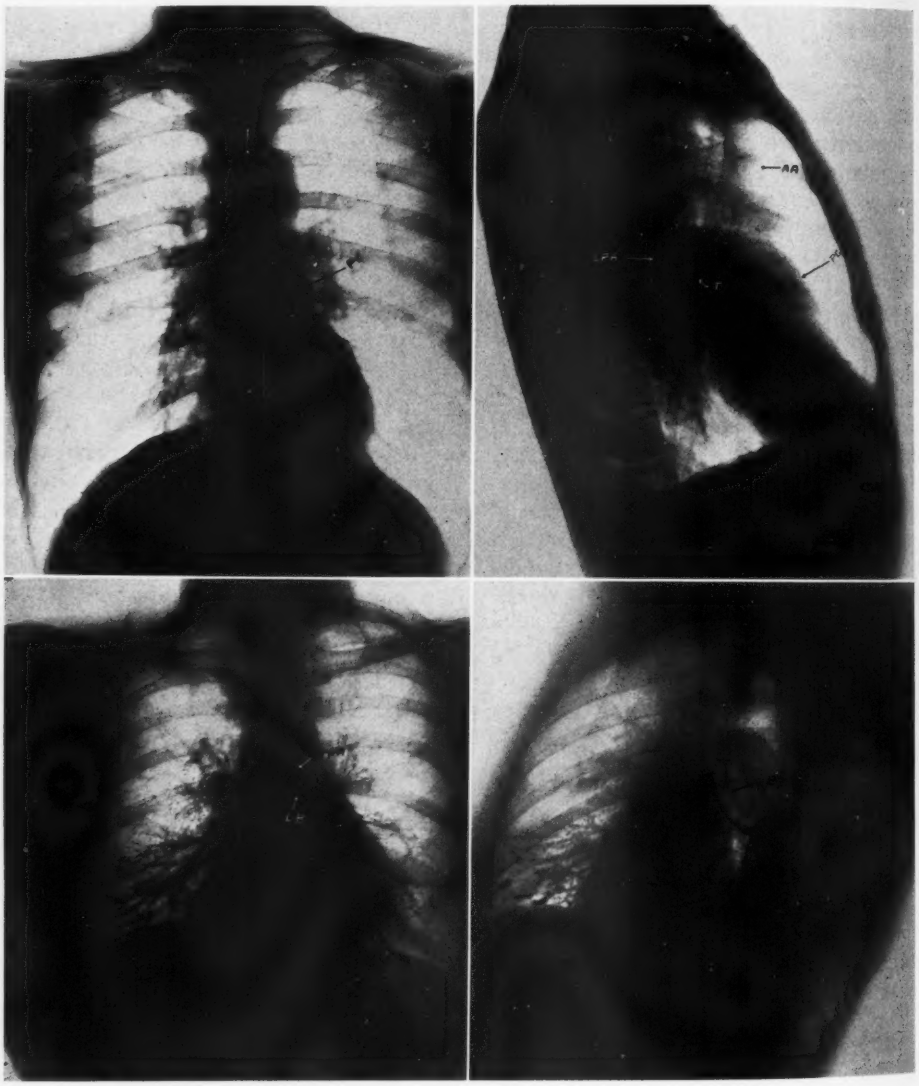

Fig. 1-*A* (*upper left*). Anterior view. Heart and aorta are normal. Pulmonary conus (P.C.) somewhat prominent. Lungs slightly emphysematous.

Fig. 1-*B* (*upper right*). Lateral view. Pulmonary conus (P.C.) distinctly outlined and denser than aortic arch (A.A.). Left pulmonary artery (L.P.A.) crossed by trachea (T).

Fig. 2-*A* (*lower left*). Anterior view. Tracheo-bronchial tree visualized by lipiodol injection. Bronchi rest upon left auricle. Left bronchus (L.B.) lies below right pulmonary artery (R.P.A.).

Fig. 2-*B* (*lower right*). Left anterior oblique view. Left bronchus (L.B.) lies within the aortic window (A.W.).

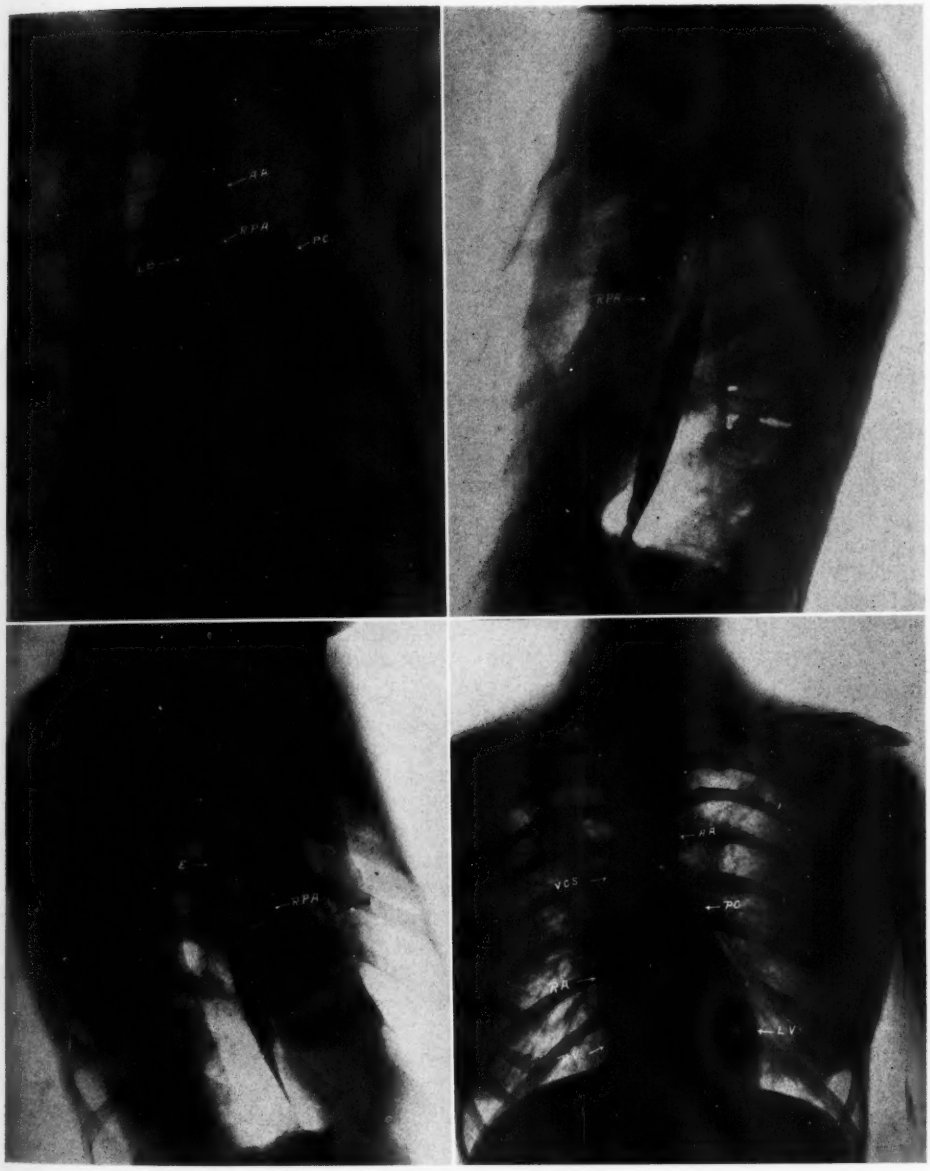

Fig. 2-*C* (*upper left*). Right anterior oblique view. Right pulmonary artery (R.P.A.) lies above left bronchus (L.B.). Pulmonary conus (P.C.) somewhat prominent. Impression upon trachea by the aortic arch (A.A.).

Fig. 3-*A* (*upper right*). Left anterior oblique view. Esophagus crosses the aortic arch behind trachea and right pulmonary artery (R.P.A.).

Fig. 3-*B* (*lower left*). Right anterior oblique view. Pulmonary conus (P.C.) somewhat prominent. Oval-shaped dense shadow due to cross-section of right pulmonary artery (R.P.A.). Aortic impression upon esophagus (E).

Fig. 4-*A* (*lower right*). Anterior view. Normal heart and great vessels. The several arcs are distinctly outlined. Aortic arch (A.A.), pulmonary conus (P.C.), left ventricle (L.V.), right auricle (R.A.), vena cava superior (V.C.S.), right ventricle (R.V.).

shadow of moderate density due to the right pulmonary artery. Both bronchi at their origin rest upon the upper surface of the left atrium.

In the left anterior oblique (Fig. 2-*B*) the aortic arch is readily outlined. Within the loop of the arch is the transparent aortic window which includes the lower end of the trachea and the origin of the major bronchi, especially the left one. The right pulmonary artery is in the anterior portion of the loop. In general, a diminution or complete obliteration of the aortic window follows dilatation of the left atrium and right pulmonary artery, such as often occurs in mitral lesions or in some types of congenital heart disease. Increase of the aortic window is usually found in aortic lesions with dilatation or elongation of the aorta. This fact may at times help to differentiate mitral from aortic lesions.

In the right anterior oblique (Fig. 2-*C*) the conus is usually projected toward the periphery of the vascular shadow on the left side. This is the most advantageous position in the study of the conus. The relationship existing between the right pulmonary artery and the left bronchus within the aortic loop is readily recognized. The impression of the aortic arch upon the left wall of the trachea is distinctly noted, a fact not usually recognized.

The relationship which exists between the aortic arch, trachea, pulmonary arteries, and the esophagus is shown in the illustrations which follow. In the anterior position the esophagus lies in front of the spine, crossing the aortic arch on its right side. In the left anterior oblique (Fig. 3-*A*) the esophagus crosses the aortic arch just behind the trachea. Below the arch it is in relation with the right pulmonary artery and right bronchus in front, and descending aorta behind. In the right anterior oblique (Fig. 3-*B*) the aortic impression upon the barium-filled esophagus is distinctly noted and just below it there is a slight impression produced by the right pulmonary artery.

From the above description it is evident that the pulmonary conus, being in front, is in relation with the ascending aorta and aortic knob but bears no relation to the trachea, esophagus, or bronchi. The left pulmonary artery is in relation with the left bronchus, which lies below it but only after its exit from the aortic loop. The right pulmonary artery is in relation with the left bronchus and lesser curvature of the arch within the loop, and right bronchus and lower end of the trachea and esophagus outside the loop. Both bronchi rest upon the upper surface of the left atrium which constitutes the lower and anterior boundary of the aortic window.

With a knowledge of the relationship one can readily note the effect of one structure upon the other in the presence of enlargement or dilatation of an adjoining structure. Thus when the pulmonary conus is dilated it usually overlaps the ascending aorta and aortic knob. Enlargement of the right ventricle invariably displaces the conus upward and to the left, so frequently noted in mitral lesions and congenital heart disease. Dilatation of the left auricle displaces the conus forward and upward, also as noted in mitral lesions. Dilatation of the right pulmonary artery often obscures the aortic window, especially when accompanied by dilatation of the left atrium. In the presence of dilatation of the right pulmonary artery an impression upon the anterior wall of the esophagus is occasionally produced. The trachea and esophagus are often displaced backward as a result of dilatation of the left atrium and right pulmonary artery.

The blood vessels which originate from the pulmonary arteries divide and subdivide throughout the lung parenchyma, presenting a characteristic pattern upon the roentgenogram consisting of dense linear markings which gradually diminish in their caliber from the hilum toward the periphery of the lung. The vessels of the lung are highly distensible and their capacity alters with changes in intrathoracic pressure incident to the respiratory movements. In the presence of an impediment to the normal pulmonary circulation, di-

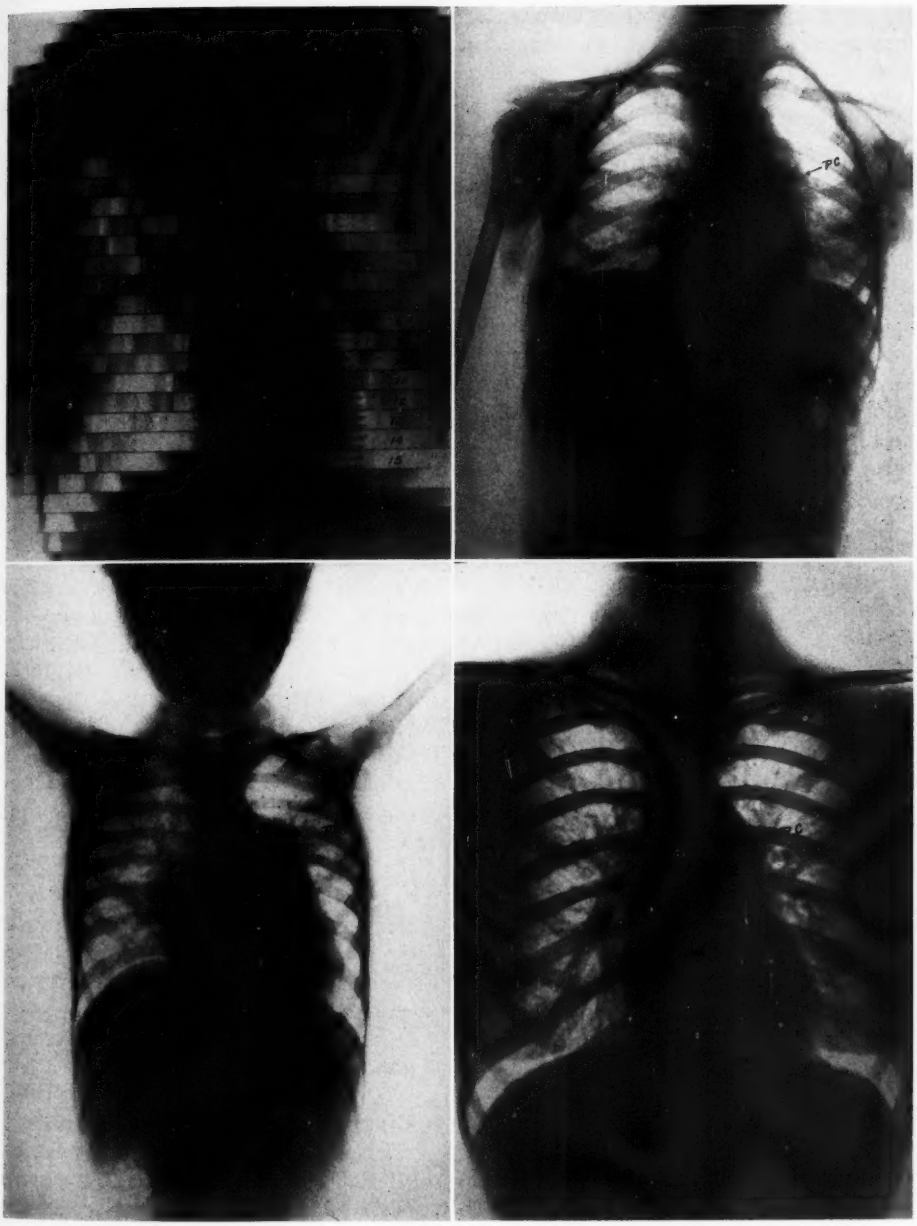

Fig. 4-*B* (*upper left*). Anterior roentgen kymogram. Left frames: 1–2 aortic waves, 4–5 pulmonary conus, 7 auricular, 9–15 left ventricular. Right frames: 1–8 vena cava superior, 9–11 right auricular, 12–15 right ventricular.

Fig. 5 (*upper right*). Anterior view. Pulmonary conus (P.C.) greatly dilated and overlaps the aortic arch in a case of open ductus arteriosus (congenital).

Fig. 6 (*lower left*). Anterior view. Heart is enlarged. Pulmonary conus (P.C.) quite prominent in a case of pulmonary stenosis (congenital).

Fig. 7-*A* (*lower right*). Anterior view. Pulmonary conus (P.C.) quite prominent in a case of possible open ductus arteriosus (congenital).

latation of the blood vessels will result, evidenced on the roentgenogram by accentuation of the blood vessel markings and decrease of the transparency of the lung-field.

Roentgen Physiology of the Pulmonary Artery.—The movements of the heart and great vessels are usually studied fluoroscopically. The pulsations of the auricles, ventricles, and large vessels and the force of the heartbeat are observed. As a rule, the pulsations of the ventricles are of greater force than those of the auricles. Those of the aorta and pulmonary artery are of about the same force but less than the ventricular. The fluoroscope enables one to obtain a fairly good idea as to the degree of the force, rhythm, and rate of the pulse. However, the method has its inherent limitations. At best it offers only a temporary visual impression subject to the prejudices of the observer. It is absolutely impossible to recognize the minute changes in the pulsations during diastole and systole as a result of physiological or pathological manifestations in the cardiovascular system. It is for the above reason that roentgenologists have for a long time searched for a method which would enable them to obtain permanent records of the visible motions of the heart and great blood vessels.

In 1911 Sabat (3), followed by Gott and Rosenthal (4) in 1912, was the first to introduce a method for recording the pulsations of the heart and great vessels. The technic was improved by Crane (5) in 1916, and perfected by Stumpf (6) in 1928. In this country Hirsch (7), Scott and Moore (8), and Johnson (9) have made outstanding contributions and are chiefly responsible for the great interest American roentgenologists have displayed in recent years in this field.

In brief, the principle and technic of this method, known under the name of "roentgen kymography," consist in the graphic registration on a photographic film of the movements of the heart and great vessels during systole and diastole. Such a record exhibits curves or waves along the borders of the cardiovascular shadow varying more or less in form, depending upon their origin, *viz.*, auricles, ventricles, and vessels (Figs. 4-*A* and 4-*B*). The apices of the curves represent the diastolic phase, the troughs the systolic. The curves have certain common characteristics which consist of two limbs, an ascending diastolic and descending systolic, converging to form an acute angle at the periphery. The amplitude of the curves depends upon the force of the heartbeat, which determines the distance travelled between the diastolic and systolic phase. The ventricles exercising the greatest force, their waves are usually of greater amplitude than those of the auricles, whose force is limited, while those of the vessels are intermediary. The form of the wave is triangular, varying more or less in the degree of the angle depending upon the difference in the relative time duration of the systolic and diastolic phases. Since the systolic phase occupies less time than the diastolic, the triangles produced will vary from one which is at right-angles to the base (as in the vessels) to one which is acute (as in the ventricles). In all cases the diastolic angle is more acute than the systolic. The angles produced in the auricular waves are too minute to lend themselves to any kind of analysis.

In the presence of functional or organic changes in the heart, valves, or vessels there may occur alterations in the form and amplitude of the curves, a knowledge of which will enable one to arrive at a more accurate diagnosis than is possible on the plain roentgenogram alone or by the fluoroscope.

Diseases of the Pulmonary Arteries.—The pulmonary conus and its branches are subject to the same diseases as the aorta and its branches, although to a lesser degree and frequency. Among the most frequent congenital lesions of the pulmonary artery are patent ductus arteriosus and stenosis. They are usually characterized by dilatation of the pulmonary conus. An example of the former is illustrated in the case of J. K., aged 9 years (Fig. 5), whose film shows marked dilata-

tion of the pulmonary conus, which projects laterally and upward, obscuring entirely the aortic knob. The heart is not enlarged. An example of the latter is that of R. V., aged 4 years (Fig. 6). The conus is quite dilated, with enlargement of the

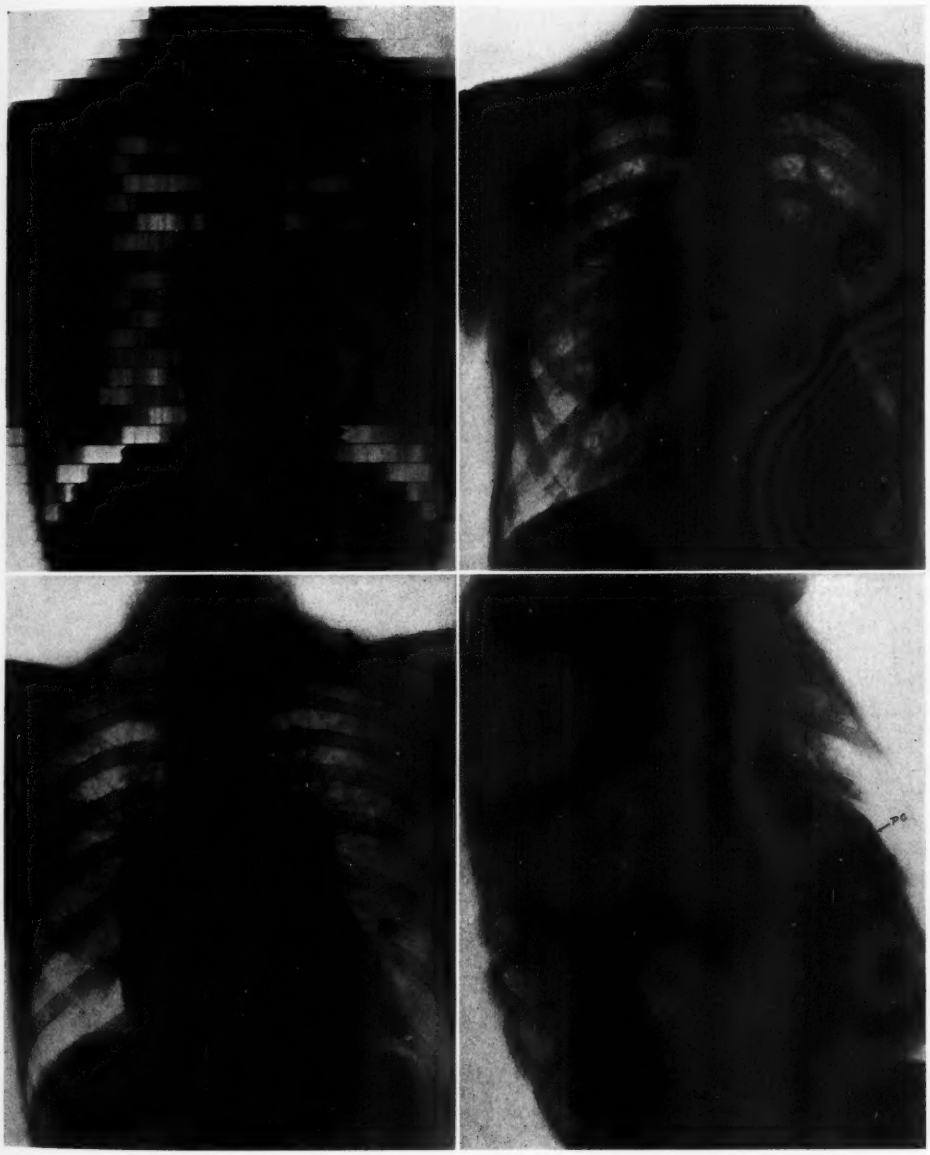

Fig. 7-*B* (*upper left*). Anterior roentgen kymogram. The waves of the pulmonary conus are quite prominent.

Fig. 8 (*upper right*). Anterior view. Heart is enlarged. Pulmonary conus (P.C.) greatly dilated. Pulmonary vessels (P.V.) much distended in a case of intraventricular perforation (congenital).

Fig. 9-*A* (*lower left*). Anterior view. Heart is enlarged, especially right ventricle. Pulmonary conus (P.C.) prominent. Pulmonary vessels somewhat distended. Aortic arch normal in case of mitral lesion.

Fig. 9-*B* (*lower right*). Right anterior oblique view. Pulmonary conus (P.C.) very prominent. Esophagus is displaced backward by a dilated left auricle.

heart, especially to the right. The clinical and physical findings definitely confirmed the x-ray findings.

A case of dilated pulmonary conus but without positive clinical and physical evidence of patent ductus arteriosus is presented by F. I., aged 14 years. In the anterior view (Fig. 7-*A*) the pulmonary

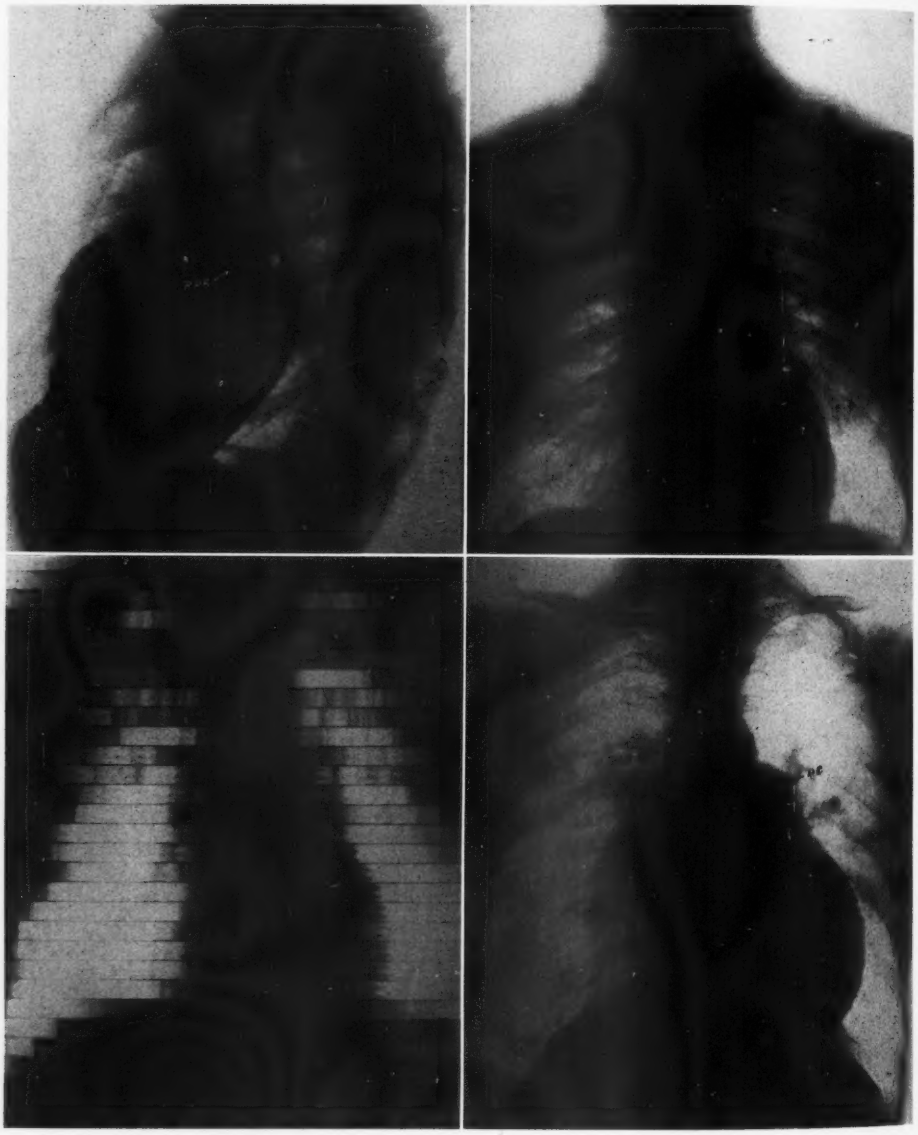

Fig. 9-*C* (*upper left*). Left anterior oblique view. The heart is globular in shape. Right ventricular border projects forward. Left auricular border displaces esophagus backward. The aortic window is obscured by dilatation of right pulmonary artery (R.P.A.).

Fig. 10-*A* (*upper right*). Anterior view. The configuration of the heart and vessels is of a typical mitral lesion.

Fig. 10-*B* (*lower left*). Anterior roentgen kymogram. The pulmonary conus waves are increased in amplitude.

Fig. 11-*A* (*lower right*). Anterior view. Heart is enlarged. Pulmonary conus (P.C.) is prominent. Pulmonary vessels are distended.

conus is markedly dilated though the pulmonary arteries are not affected. The heart is of normal size and shape. In the roentgen kymogram (Fig. 7-*B*) the amplitude of the waves of the pulmonary conus is definitely increased, indicating increased force and possibly increased pulmonary hypertension.

The question as to whether or not increased amplitude of the waves of the pulmonary conus is indicative of pulmonary hypertension cannot be definitely answered. In systemic hypertension the amplitude of the waves of the aorta is not increased and at times even diminished. Why not apply the same rule in the case of the pulmonary artery? However, we have noted in cases of pulmonary emphysema, which are generally considered to have increased pulmonary hypertension, that the waves are of greater amplitude.

Intraventricular perforation with pulmonary stenosis is presented by the case of J. H., aged 32 years. The roentgenogram (Fig. 8) shows enlargement of the heart with considerable dilatation of the pulmonary conus. The pulmonary arteries are greatly distended. The diagnosis of congenital heart disease was made, although the physical findings tended to suggest an acquired lesion. On postmortem examination the intraventricular septum was found to be patent. The pulmonary conus, however, was not so much dilated as the roentgenogram had indicated. This suggests that the dilatation was of a dynamic origin existing only during life.

Among the acquired lesions mitral valvular disease is almost always accompanied by dilatation of the pulmonary conus and frequently also by dilatation of the pulmonary arteries and their branches.

The following case of a male, aged 52 years, is a typical example of mitral disease as revealed on roentgenograms taken in several positions. In the anterior view (Fig. 9-*A*) the heart is enlarged, especially to the right side. The cardiovascular notch is elevated on the right border, indicating enlargement of the right ventricle. The pulmonary conus is prominent. The left auricular salient is bulging laterally, obliterating the so-called waist-line. The pulmonary arteries are somewhat dilated. The aorta is of hypoplastic caliber. In the right anterior oblique (Fig. 9-*B*) the prominence of the pulmonary conus is quite marked. The esophagus is displaced backward by the greatly distended left auricle. In the left anterior oblique (Fig. 9-*C*) the right ventricle is enlarged as shown by the forward projection of its anterior border. The lower end of the trachea, major bronchi, and esophagus are displaced backward due to dilatation of the right pulmonary artery and left auricle. The so-called aortic window is entirely obliterated as a result of the above-mentioned changes. The reverse takes place in aortic lesions in which the aortic window enlarges. This is due to the fact that the left auricle and right pulmonary artery are not dilated, that the dilated ascending aorta moves forward and to the right and the descending aorta to the left and backward, thus increasing the diameter of the aortic loop. Attention is also called to the backward displacement of the esophagus in mitral lesions which remains behind the heart shadow through its entire course in the left anterior oblique position, while in aortic lesions associated with left ventricular enlargement the esophagus crosses the left ventricle when viewed in the same position.

The roentgen kymographic findings in mitral lesions are illustrated by the case of A. P., aged 24 years. The anterior view (Fig. 10-*A*) presents the usual findings of an early mitral stenosis. The heart is moderately enlarged, especially to the right; the cardiovascular notch is elevated on the right border, indicating enlargement of the right ventricle. The pulmonary conus is only slightly prominent. The so-called waist-line on the left side is obliterated, while the aorta is not dilated. In the roentgen kymogram (Fig. 10-*B*) the amplitude of the aortic pulsations is within normal limits while that of the pulmonary conus is quite prominent and beyond the normal limits of physio-

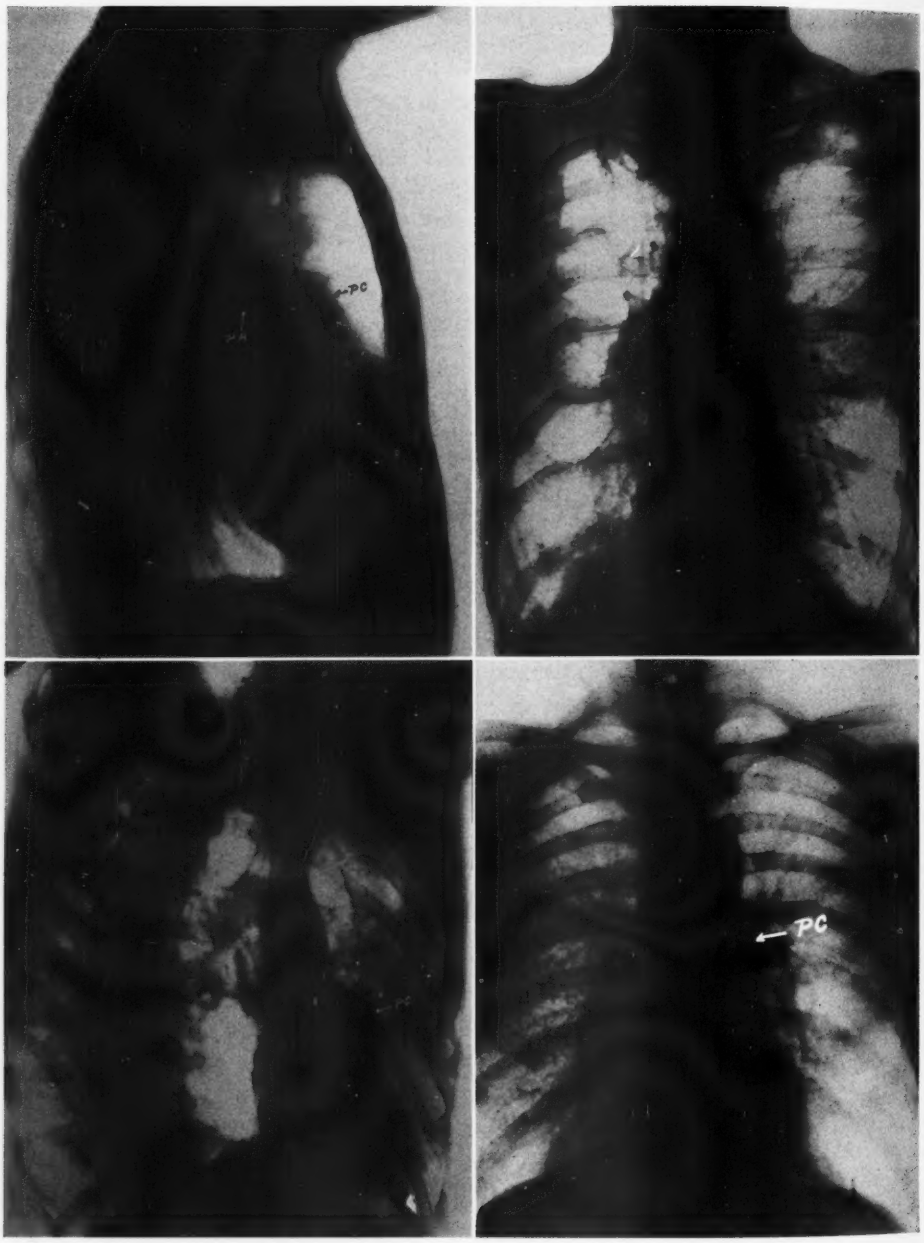

Fig. 11-*B* (*upper left*). Lateral view. Pulmonary conus (P.C.) and pulmonary arteries (P.A.) are dilated and show an increase in density due to sclerosis of pulmonary artery.

Fig. 12-*A* (*upper right*). Anterior view. Heart is small. Pulmonary conus only slightly prominent. Lungs are emphysematous.

Fig. 12-*B* (*lower left*). Right anterior oblique view. Pulmonary conus (P.C.) is markedly dilated. Sclerosis of pulmonary artery confirmed by necropsy.

Fig. 13-*A* (*lower right*). Anterior view. Heart is normal. Pulmonary conus (P.C.) slightly prominent.

logical variations. The amplitude of the waves of the left ventricle is normal, while that of the right is definitely enlarged. Such a finding is the usual one with a well-compensated heart. However, when the heart is greatly enlarged and has lost its tone the pulsations are of very small amplitude.

Arteriosclerosis of the pulmonary arteries is a frequent finding in pulmonary diseases such as emphysema, chronic bronchitis, chronic pleurisy, chronic pulmonary tuberculosis, congenital and acquired heart disease and idiopathic cases in which no definite cause is accountable for the sclerosis. Sclerosis may or may not be associated with dilatation of the pulmonary vessels, the former, however, being more frequent. In the aged, sclerosis of the arteries is often found without much dilatation of the vessels.

A good example illustrating a so-called idiopathic pulmonary sclerosis is that of Dr. H. S., aged 54 years, who for many years complained of symptoms referable to the chest but without definite physical findings except for moderate enlargement of the heart. In the anterior view (Fig. 11-*A*) the heart is somewhat enlarged. The pulmonary conus and arteries are dilated, the aorta being of normal caliber. In the lateral view (Fig. 11-*B*) the pulmonary conus and arteries are dilated and show great increase in density. It is evident that the lateral view is of considerable assistance in enabling one to obtain a more accurate knowledge of the condition than is possible by the anterior view alone, and this has been found to be the case in many other instances. The patient died suddenly but no necropsy was obtained. Since the lungs presented such minimal changes one might conclude that this case was a primary arteriosclerosis of the pulmonary artery.

An example of secondary arteriosclerosis of the pulmonary artery is illustrated by the following case of a man, aged 49 years. In the anterior view (Fig. 12-*A*) the lungs present marked emphysema. The apices show dense calcified deposits, evidence of an old tuberculous infection. The diaphragm is very low and its excursions are almost absent. The heart is elongated and rather small. The pulmonary conus does not appear to be enlarged. In the right anterior oblique view (Fig. 12-*B*) the pulmonary conus is quite prominent and is of dense consistence. The diagnosis of arteriosclerosis of the pulmonary artery was confirmed by necropsy.

Attention has been called before to the direct relationship existing between the right pulmonary artery and the esophagus. Under normal conditions the barium-filled esophagus is not affected by the vessel as is the case with the aortic arch. In the presence of dilatation of the right pulmonary artery the esophagus may present an impression in its contour. This is well shown by the case of patient A. P. In the anterior view (Fig. 13-*A*) the heart and aorta are within normal limits. The pulmonary conus is somewhat prominent. In the right anterior oblique (Fig. 13-*B*) the pulmonary conus appears quite prominent. Opposite the conus on the posterior border there is a distinct impression upon the contour of the esophagus produced by the dilated right pulmonary artery. Above, there is another one, somewhat smaller, produced by the aortic arch.

The case of patient F. B. illustrates the roentgen kymographic findings of arteriosclerosis of the pulmonary artery. In the anterior view (Fig. 14-*A*) the heart shows moderate left ventricular enlargement and calcified plaques in the aortic wall. The pulmonary conus is quite prominent. The roentgen kymogram (Fig. 14-*B*) shows pulsations of great amplitude, especially in the regions of the pulmonary conus and right ventricle.

A case of peri-arteritis nodosa, the only one proven in our experience, is that of a male, S. C., aged 74 years. The anterior view (Fig. 15) presents marked enlargement of the heart and dilatation of the aorta and pulmonary conus. The pulmonary vessels are greatly dilated on both sides of the heart, especially marked on

the right side, and extend considerably into the lung-fields. On necropsy the condition was found to be due to peri-arteritis nodosa.

Aneurysms of the pulmonary conus are comparatively rare. When they are found they must be differentiated from aneurysms of the aorta and mediastinal or lung tumors. An aneurysm of the pulmonary conus is illustrated by patient I. K., a white woman, aged 39 years. In the anterior view (Fig. 16-*A*) the heart is shown to be

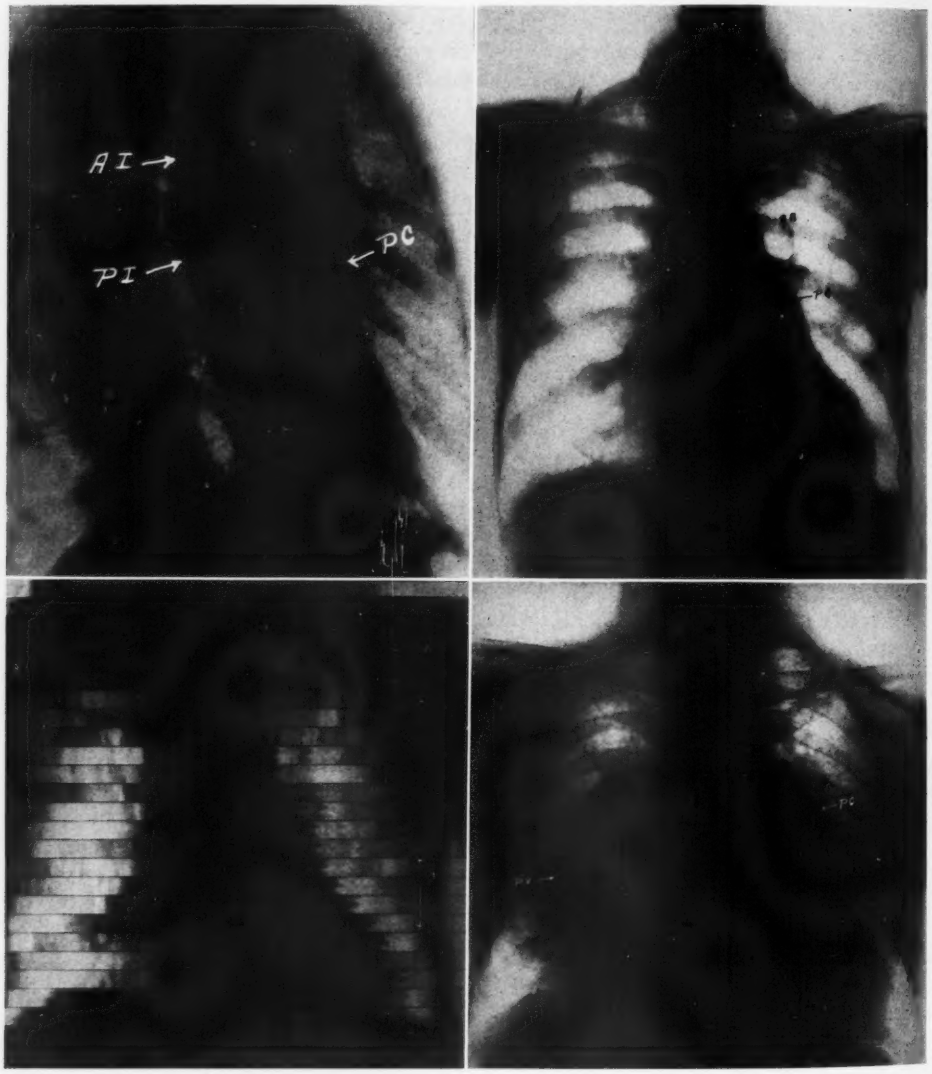

Fig. 13-*B* (*upper left*). Right anterior oblique view. Pulmonary conus (P.C.) quite prominent. Right pulmonary artery is dilated, producing a pulmonary impression (P.I.) upon esophagus. Above is the aortic impression (A.I.).

Fig. 14-*A* (*upper right*). Anterior view. Left ventricle is somewhat enlarged. Pulmonary conus (P.C.) is quite dilated. Calcified plaques in aortic arch (A.A.).

Fig. 14-*B* (*lower left*). Anterior roentgen kymogram. The waves of the pulmonary conus show an increase in amplitude.

Fig. 15 (*lower right*). Anterior view. Heart is enlarged. Pulmonary conus (P.C.) is greatly dilated. Pulmonary vessels (P.V.) markedly distended in a case of peri-arteritis nodosa, confirmed by necropsy.

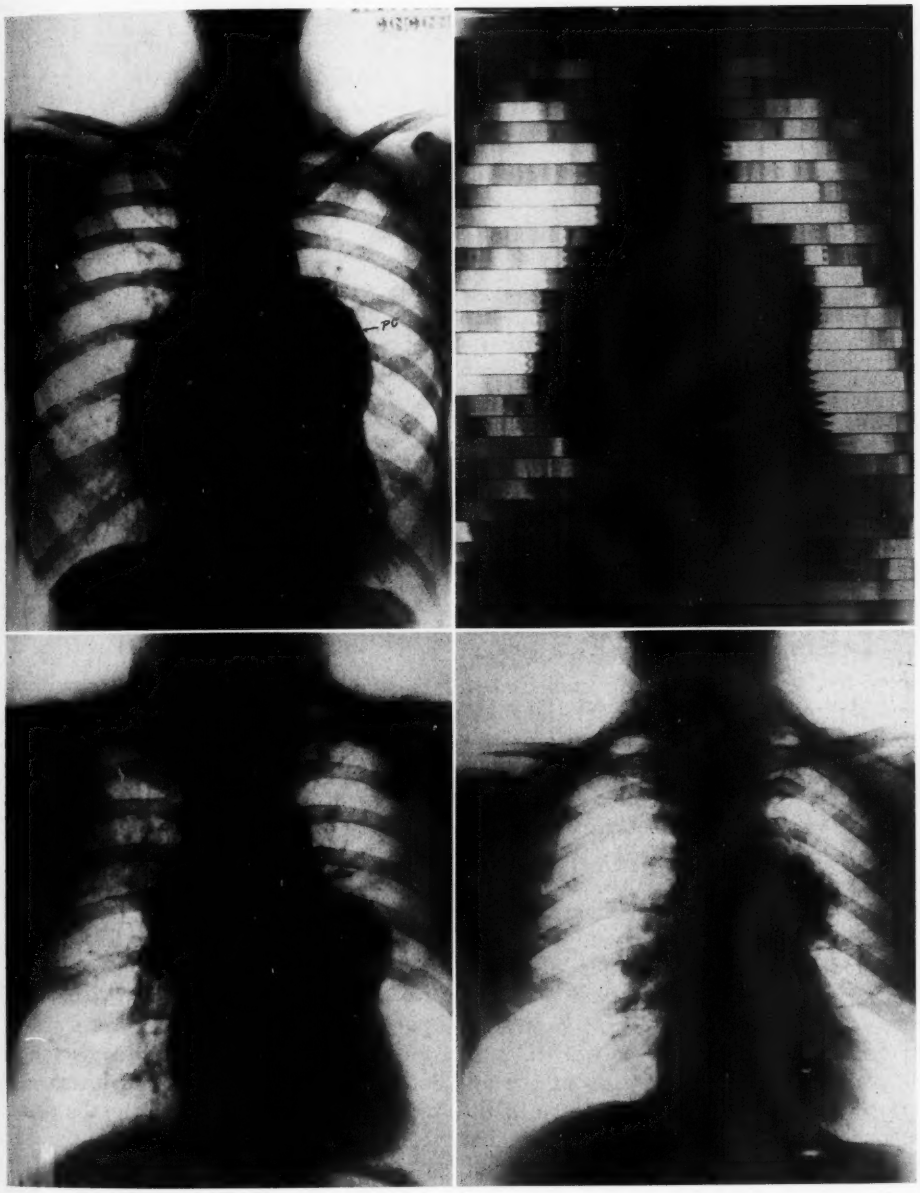

Fig. 16-*A* (*upper left*). Anterior view. Heart is enlarged, especially the right ventricle. The pulmonary conus (P.C.) is markedly dilated and overlaps aortic arch due to an aneurysm.

Fig. 16-*B* (*upper right*). Anterior roentgen kymogram. The amplitude of the waves of the pulmonary conus is diminished; however, the presence of waves proves it to be an aneurysm and not a tumor.

Fig. 17 (*lower left*). Anterior view. Heart shows enlargement of left ventricle. Aorta is dilated. In region of pulmonary conus there is a large bulging over (but not overlapping of) the aortic arch due to an aneurysm of the sinus of Valsalva.

Fig. 18 (*lower right*). Anterior view. Heart and vessels are normal. Large prominence in region of pulmonary conus overlapping aortic arch. Esophagus and trachea displaced to right, indicating the location of the shadow in posterior mediastinum; proven by the x-ray therapeutic test to be due to a pulmonary tumor.

enlarged to the right. The cardiovascular notch on the right border is elevated, indicating enlargement of the right ventricle: the left ventricle and aorta are within normal limits. In the region of the pulmonary conus there is a marked prominence which appears to originate from the vessel and partially overlaps the aortic arch. The roentgen kymogram (Fig. 16-*B*) shows pulsations of very low amplitude in the region of the expanded conus, indicating impairment of the vessel wall due to an aneurysmal dilatation and not to a mediastinal tumor.

Aneurysms arising from the sinus of Valsalva and projecting to the left are infrequent. When they do occur they offer some difficulty in differentiating them from aneurysms of the pulmonary conus, since they occupy the same region. There are, however, certain distinguishing characteristics, as illustrated by the following case of patient F. A., aged 47 years. In the anterior view (Fig. 17) the heart is enlarged to the left while the aorta is dilated. The cardiovascular notch on the right border is lowered, indicating elongation of the aorta. The prominence in the region of the pulmonary conus is on a lower level and does not overlap the aortic arch as occurs with dilatation of the pulmonary conus. In other words, this case has all the secondary changes which are usually found with an aortic aneurysm.

A mediastinal or lung tumor located in the region of the pulmonary conus may offer some difficulty in differentiation from an aneurysm. The case of M. R., aged 59 years, white, male, reveals in the anterior view (Fig. 18) a prominence in the region of the pulmonary conus. The heart and aorta are apparently normal. The trachea and barium-filled esophagus are somewhat displaced to the right. This fact indicates that the abnormal shadow is related to the posterior mediastinum and not to the pulmonary conus or ascending aorta, which are located anteriorly. The diagnosis of pulmonary tumor was confirmed by the therapeutic test as it completely disappeared under x-ray treatment.

CONCLUSION

The normal roentgenographic and roentgen kymographic appearance of the pulmonary conus and vessels and their relationship in various positions are described. Cases illustrating congenital and acquired lesions in which the pulmonary conus and vessels are involved are presented. The differential diagnosis between aneurysm of the pulmonary conus and aorta and mediastinal or lung tumors is discussed and illustrated.

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DISCUSSION

George Levene, M.D. (Boston): The paper presented by Dr. Brown treats of an important and rather neglected field of roentgen exploration. Disease of the pulmonary arteries themselves is common enough to require investigation. Moreover, changes are effected in the larger branches and vascular bed as a result of many varieties of pulmonary pathology. The lesser circulation is intimately associated with the heart so that changes occurring in one are in time reflected in the other.

Congenital lesions of the pulmonary artery are more commonly recognized because the changes are gross and rather

marked. Pulmonary stenosis, patent ductus arteriosus, and transposition of the great trunks all give rise to characteristic pictures. The formation of arterio-venous aneurysms in the hilar branches produces large, dense hilar shadows occasionally mistaken for enlarged nodes or neoplasms.

Dr. Brown has not stressed sufficiently the need for thorough fluoroscopic examination which, in our experience, is the most satisfactory means of localization and of differentiating orthoctonous and transmitted pulsation.

While I agree with Dr. Brown and Dr. Hirsch and Dr. Scott about the general usefulness of the kymogram, I still would like to make a plea that you do not abandon fluoroscopic study. It brings you into intimate contact with your patient; you will have a chance to make your personal observations by seeing the organ in motion, and you are studying the phenomenon of motion. In our experience in a rather large heart clinic, we feel that fluoroscopy is absolutely indispensable.

For example, in patent ductus arteriosus blood may be shunted from the aorta to the pulmonary artery, or from the pulmonary artery to the aorta. In the former case, the ascending aorta shows increased pulsation and the descending aorta diminished pulsation, while in the pulmonary artery-to-aorta shunt the findings are reversed—there are diminished pulsations in the ascending aorta and increased pulsations in the descending aorta.

The importance of changes in the vascular bed in such common conditions as mitral valvular disease may be emphasized. Increased pressure arising within the left auricle and transmitted backward into the lungs produces pulmonary congestion and so-called "brown induration." This frequently results in the production of râles and hemoptysis and is a common cause of the mistaken clinical diagnosis of pulmonary tuberculosis.

In reviewing a series of 100 cases of pulmonary asbestosis, it was interesting to note that the most constant change was enlargement of the primary branches of the pulmonary artery. The typical or pulmonale, probably resulting from increased resistance to the flow of blood into the lungs as a result of fibrosis, emphysema, or other change, is of course a lesion of the lesser circulation.

Our knowledge is still very incomplete concerning the roentgenologic aspects of pulmonary thrombosis, Ayerza's disease, and pulmonary hypertension. The work of Dr. Brown and his colleagues is important. Such investigations, supplemented by the procedures recently introduced by Robb and Steinberg for the visualization of the heart chambers and vessels, will in time disclose a wealth of hidden treasure.

SAMUEL BROWN, M.D. (*closing*): Dr. Levene calls attention to the fact that I have not sufficiently emphasized the use of the fluoroscope in my paper. I wish to state that practically every cardiovascular case receives a thorough fluoroscopic examination before any roentgenograms or roentgen kymograms are made.

CROSS-SECTIONAL RADIOGRAPHY OF THE HEART

By GERHARD DANELIUS, M.D., *Chicago*

From the Roentgenological Department of the Mount Sinai Hospital

A ROENTGENOLOGIC visualization of the heart, in such a manner as to give a radiologic equivalent to its anatomical cross-section, has been an old problem in cardiac roentgenology.

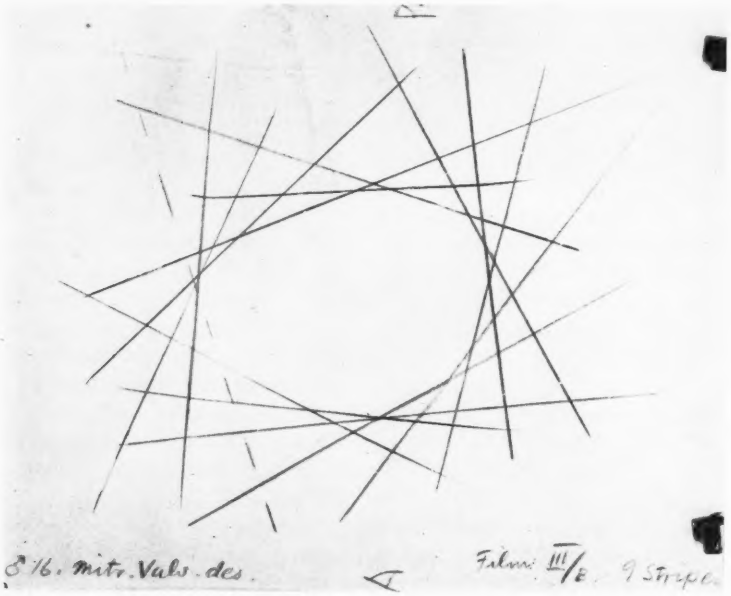

Fig. 1. Drawing of cross-sectional roentgenogram following the old method based on the 360-degree rotation of the patient. (*From Szabados,* RADIOLOGY, **27,** *693, December, 1936.*)

This problem has been approached repeatedly in the past. The several available solutions are, however, complicated, time-consuming, not very exact, and require additional expensive equipment. The underlying principle for all these methods is based on the 360° rotation of the patient around his vertical axis with the recording of the heart borders in different diameters. In this manner, the cross-section can be reconstructed. Some authors go beyond this and produce three-dimensional models of the heart. Palmieri (4), in a very elaborate manner, cuts cardboard silhouettes of many different heart diameters and in setting them together completes the heart model. Lysholm (3) designed an ingenious arrangement permitting direct cutting of a three-dimensional heart model from clay. A rotating chair for the patient is connected with a rotating stand for the clay and an exact correlation with their degree of rotation is maintained. A narrow beam around the central ray is moved under fluoroscopic control along the heart borders. A steel string, mechanically connected with the tube, automatically cuts through the clay so that an approximate model of the heart is fashioned after cutting several diameters. This method was later revived by Schatzki (5). Klason

(2) devised an attachment by which an electric rod mechanically follows the movements of the central ray controlled by the fluoroscopist and produces strip-like exposures on photographic paper as desired. He thus obtains a number of lines which produce an approximate outline of a cross-section through the heart. A similar principle for drawing under fluoroscopy or indirectly, after exposing several film strips at different angles, was recently published in this country by Szabados (6). (See Fig. 1.)

Fig. 2. Lateral view of the thorax demonstrating the oblique orientation of the long axis of the heart (*D*) in relation to the longitudinal axis of the thorax.

All these methods, unfortunately, take considerable time, and any motion of the patient during the long examination greatly endangers the accuracy of the measurements. It is, furthermore, not possible to record fine details of the heart contour. Were a direct, instantaneous exposure of the cross-section of the heart possible, its superiority over the indirect methods described above would be apparent.

The purpose of this study is to present such a roentgenologic possibility for a direct cross-section radiography of the heart using a fundamentally different projection from those commonly accepted. This study is

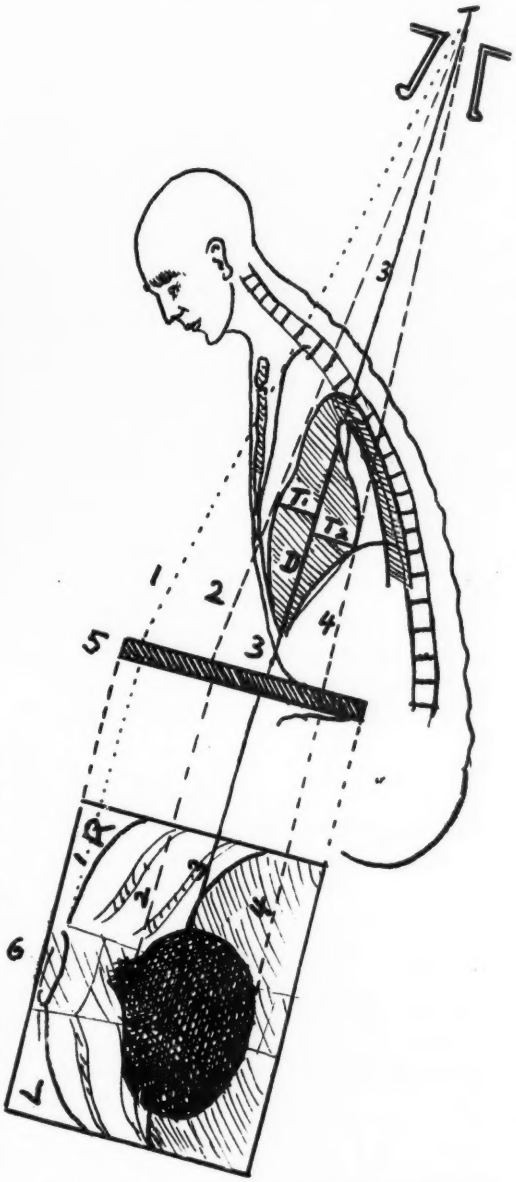

Fig. 3. Technic of cross-section roentgenography of the heart. The central ray (3) is directed along the long axis of the heart (*D*). The cassette (5) is placed deep into the cardiac groove perpendicular to the central ray (3). Lines 2 and 4 indicate the projection of the anterior and posterior heart border; line 1, the projection of the pulmonary apex; 6 is the diagram of the film.

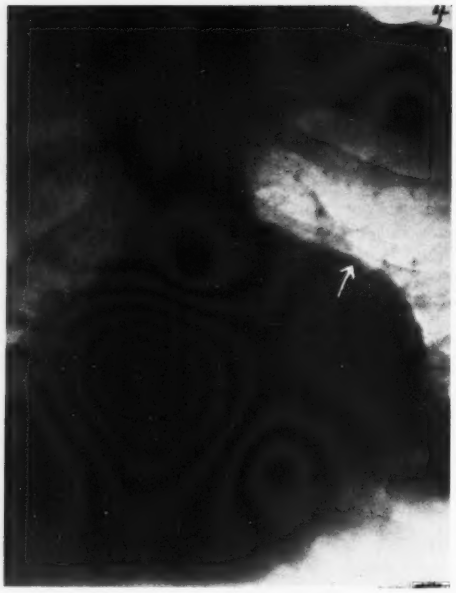

Fig. 4. Direct cross-sectional roentgenogram of the heart with good visualization of the border between the right and left ventricles (arrow).

limited only to its theoretic principles and roentgen-technical factors. The roentgen-clinical aspects of this method will be summarized in a later study.

The principle underlying this technic is easily understood (Figs. 2 and 3). On examining a lateral view of the chest, we note that the long axis of the heart—its diagonal diameter—forms an angle averaging from 45 to 50 degrees with the longitudinal diameter of the thorax. This angle is increased in obese and emphysematous patients and decreased in asthenic types. Making use of this oblique orientation of the heart within the thorax, a technic was developed as follows: first, a fluoroscopic examination of the thorax in the lateral direction is done and the diagonal axis of the heart and the curved line of the diaphragm are marked on the skin at the lateral surface of the thorax. The diagonal diameter is the line connecting the posterior point of origin of the aorta with the heart portion which fills out the sterno-diaphragmatic angle (Fig. 2). The patient then is placed on a chair with his head and thorax moderately bent forward; an x-ray film is placed into the cardiac groove, pushed backward as far as possible, and held in position by both hands of the patient. The x-ray tube is placed above the patient, the central ray is directed corresponding with the diagonal axis of the heart as marked on the patient's skin, entering the body through the upper dorsal spine and leaving through the sterno-diaphragmatic angle (Fig. 3). To avoid distortion for purposes of mensuration, care should be taken that the angle formed by the cassette with the central ray shall be exactly 90 degrees. The posture of the patient as well as proper centration should not offer any difficulties. Contrary to expectations, the films come

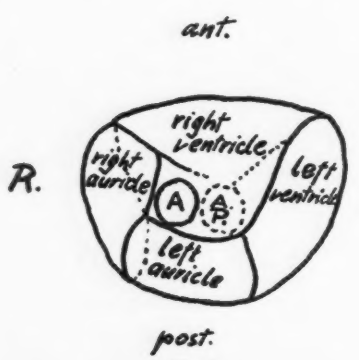

Fig. 5.

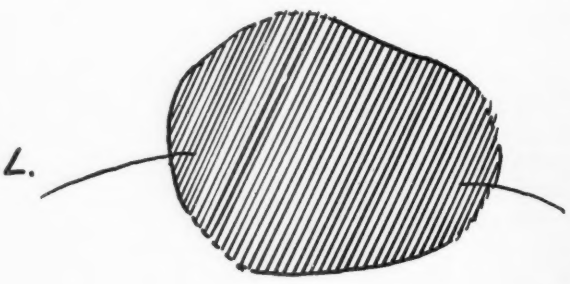

Fig. 6.

Fig. 5. Topographic anatomy of the heart as seen in a cross-sectional roentgenogram. (*From Klason, Acta Radiol.*, **11**, 64.)

Fig. 6. Cross-sectional roentgenogram in moderate enlargement of the left ventricle.

out well defined (Fig. 4) and do not require great increase in kilovoltage or milliamperage. We use, on a two-disk mechanical rectifier, a radiation of from 80 to 83 kv.p., 80 ma., 1 m. target-film distance, and 0.2 sec. exposure time. In cases of marked obesity, marked enlargement of the liver, high abdominal tumors, pregnancy, and ascites, it is not possible to place the film sufficiently far backward to make a satisfactory examination possible.

In analyzing the radiographic picture, one must bear in mind that the film represents a horizontal cross-section through the heart within an oblique section through the thorax (Fig. 3). This is a fundamental point, because without this knowledge one would believe that the film was taken at a wrong angle and distorted. The radiogram reveals in the upper half, the ribs and lung structure corresponding to those portions located anteriorly and above the heart. The anterior surfaces of the diaphragm divide the film into an upper aerated and lower non-aerated portion. In the midline and vertical axis we note the blurred film of the cervical and upper dorsal spine bent forward during the exposure (Figs. 3 and 4).

Partly within the shadow of the diaphragm and partly projected anteriorly, we see the clearly defined egg-shaped "cross-section" of the heart. The topography of its different parts is known from anatomic studies and is well illustrated in a drawing by Klason (Fig. 5). In our projection, the right heart border is formed by the right auricle, the anterior by the right ventricle, the left by the left ventricle, and the posterior by the left auricle. These structures are anatomically located at different heights but on the film they are projected one over the other in *one* plane. Emerging anteriorly from the main heart shadow, we note on many films a triangular offshot, which is probably formed by the great veins. In hearts with a long vertical axis the vascular pedicle is visualized as a broad anterior projection. While the right ventricle anteriorly is frequently limited by a straight outline, the left one

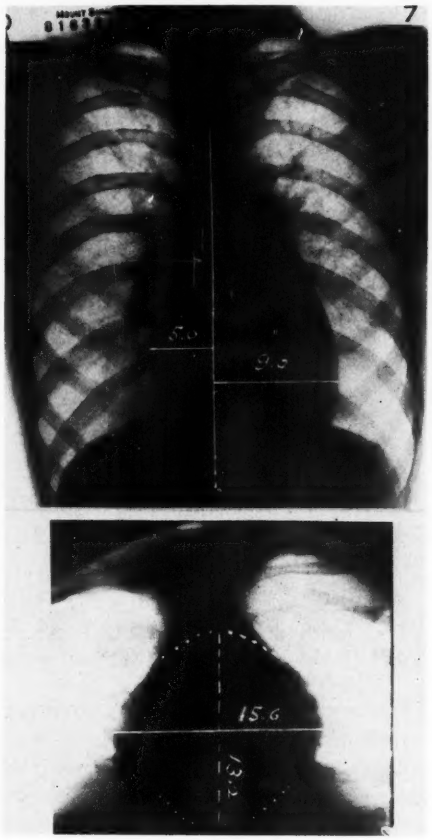

Fig. 7. Mitral stenosis. The posterior bulging of the left auricle is well visualized. The equation for the determination of the depth diameter is

$$\frac{x}{13.2} = \frac{14}{15.6} \cdot D = 11.8 \text{ cm.}$$

presents a distinct rounding. On many films the border between right and left ventricle is clearly marked (Fig. 4). The typical deformities of the heart are well demonstrated. In Figure 6 we note a moderate enlargement of the left ventricle. This, not infrequently, is directed forward and backward and the depth of the left ventricle is considerably increased. The lateral border of the enlarged ventricle often gives a blurred appearance which is probably due to a horizontal orientation of its longitudinal diameter. Figure 7 is a case of mitral stenosis with marked posterior bulging of the left auricle. The

degree of this bulging, which is first directed posteriorly and in a more advanced stage toward the right side, is easily recognized on a cross-section radiograph. Rotation of the heart around its vertical axis as in some cases of drop heart can be demonstrated, and compensation for the measurements taken on a typical six-foot film is then possible (Fig. 8).

Fig. 8. Rotation of the heart in its vertical axis in a case of drop heart is well visualized on a cross-sectional film.

This view gives valuable information for determination of the volume of the heart. If the diagonal axis has been carefully determined and placement of the cassette at a 90-degree angle with the central ray is strictly secured, mensuration of the depth diameter is possible. The correlation between the transverse diameter taken from a routine six-foot film with the transverse diameter of the cross-section radiograph will give the necessary factors for a simple mathematical equation. This permits the reduction of the non-distorted roentgenological cross-section to its actual measurements (Fig. 7).

SUMMARY

1. The fundamental anatomical and technical facts for taking a direct instantaneous "cross-section radiogram" of the heart are given.

2. The physiological angulation between the longitudinal axis of the thorax and the long axis of the heart is used to obtain, within an oblique section of the thorax, a clearly defined cross-section of the heart.

3. Not infrequently the border between right and left ventricle, not previously visible at all on any of the views used so far, is well defined.

4. Rotation of the heart in its vertical axis is well visualized.

5. Posterior enlargement of the left auricle, particularly its extension toward the right, is demonstrated.

6. If the technical requirements are exactly secured, this view is helpful for purposes of mensuration and volume determination. The measurements on the film have to be reduced to their actual values by correlating the measurement of the transverse diameter of a routine six-foot film to the transverse diameter as found on the cross-section view.

7. When this direct cross-section radiography of the heart can be obtained, it is superior to the methods based on the 360-degree rotation of the patient.

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THE TREATMENT OF ERYSIPELAS WITH ULTRA-VIOLET ENERGY[1]

By M. E. KNAPP, M.D., *Minneapolis, Minnesota*

AMONG the multitude of remedies that have been advocated and employed for the attempted cure of erysipelas, there are only a few that have been definitely shown to be of any considerable value. The most prominent of these are roentgen radiation, erysipelas streptococcus antitoxin, and ultra-violet radiation. Comparative studies upon the relative efficiencies of these methods have been carried out by several investigators. The most convincing of these studies was reported by Ude and Platou, in 1930, in a study of 402 hospitalized cases treated by various methods at the Minneapolis General Hospital. They concluded that ultra-violet radiation was the treatment method of choice. Since that time most of the cases of erysipelas at the Minneapolis General Hospital have been treated solely by ultra-violet radiation. At the same time there has been a fairly widespread acknowledgment of the efficacy of this treatment so that there have been confirmatory reports from widely separated sections of the United States. Three of these reports I will combine in the present communication.

But first it is advisable to consider more closely the subject of ultra-violet radiation for the treatment of erysipelas.

Mode of Action.—At first consideration by one who has not seen the results from this treatment it would seem highly inadvisable to impose upon "St. Anthony's Fire" the added insult of a second degree burn from ultra-violet. In fact, the exact action of ultra-violet upon erysipelas has not yet been adequately explained. It is certainly not directly bactericidal in these cases. Titus says:

"In a preliminary paper published in 1933, the only conclusion reached was that the energy increased the resistance of the tissues to the sensitizing action of the bacteria. This seemed the best lead, since frequently the entire lesion was shielded from the ultra-violet energy by pieces of cardboard, and irradiation of the surrounding tissues caused a clearing up of the infection. Radiation, with one part of the active inflamed edge covered by a piece of cardboard, stopped the advance of the entire inflamed edge and skin cultures of the radiated and non-radiated skin showed living bacteria. In the case of an infant the reaction produced on the head, where the lesion existed, was so severe that the next dose was given on the buttocks and lower back, and the disease was cleared up.

"One theory advanced by a worker at the Presbyterian Hospital is that the marked edema caused by these excessive doses of ultra-violet energy produce a specific antitoxin which is later absorbed. This is as yet unproven, but, if true, would be of great importance in the field of immunology."

The prolonged erythema produced by the ultra-violet energy may also be an important factor. This much is certain. The dosage of ultra-violet must be extremely heavy to produce the best results.

Technic and Clinical Course.—Experience has taught us that the dosage should be very heavy so that the original dosage suggested by Ude, namely, twice the erythema dose, has now been increased to from ten to twenty times the erythema dose. A border of three or four inches of normal skin around the involved area is included in the treatment. If multiple exposures are necessary, the edges are allowed to overlap. If the eyelids are not involved, the eyeballs are covered with black paper or cotton to prevent an ultra-violet conjunctivitis. If the eyelids are involved and swollen, the patient is merely instructed to keep his eyes closed during the treatment. Moist packs are prohibited for from 12 to 24 hours after the treatment, because they interfere with the proper development of the erythema. Usually no packs are necessary. If the skin feels stiff after the

[1] Presented before the Fifth International Congress of Radiology, at Chicago, Sept. 13–17, 1937.

erythema develops, a little white vaseline may be applied to relieve it. If spreading should occur, as evidenced by continued elevation of temperature and extension of the lesion, the same or an even heavier dose of ultra-violet is given the next day.

Most of the patients remark about the relief of pain which often occurs while the lamp is still being applied. Later there is some increased edema of both the area of erysipelas and the surrounding normal skin. This subsides in from 24 to 48 hours, and if no further spreads or complications occur, the temperature drops rapidly to normal, the treated area wrinkles, then desquamates, and in five or six days the entire area is replaced with fresh-looking skin. In the majority of cases only one treatment is necessary.

Comparative Statistics.—In the last few years the use of ultra-violet energy in the treatment of erysipelas has become sufficiently acceptable as the treatment of choice so that it is now possible to report the results in three widely separated portions of the United States and thus compare these statistics.

At the last meeting of the American Congress of Physical Therapy in New York in September, 1936, a paper on the treatment of erysipelas with ultra-violet radiation was presented by Dr. J. G. Jenkins, of Temple, Texas, which so closely paralleled the results found by Dr. N. E. Titus and myself, that Dr. Titus asked me to gather the comparable statistics of all three groups of patients into one paper to show the remarkable similarity of results in three widely separated sections of the United States as obtained by three groups of clinicians working in complete independence of each other.

Upon consideration of the factors which could be compared in these three series, it is evident that the comparison may be carried out under the headings of (1) the average number of treatments per case, (2) the average number of days from treatment to normal temperature, and (3) the deaths.

The comparative figures are shown in Table I.

TABLE 1

	Titus	Jenkins	Knapp
No. cases	81	50	510
Av. no. treatments	2.06	1.9	1.3
Av. no. days from treatment to normal temperature	4.58	3.13	3.75
No. deaths	2	1	38
Percentage of deaths	2.4	2	7.4

A consideration of the table shows that the average number of treatments per case and the average number of days from treatment to normal temperature are very nearly the same in the three series. The percentage of deaths is much greater in the Minneapolis series than in the others. It is probable that this can be explained by the fact that both Dr. Titus' and Dr. Jenkins' patients were largely private cases while my series was composed entirely of charity patients, many of whom waited until the last moment before allowing themselves to be taken to a hospital. In fact, 18 of these deaths were in cases in which some factor other than erysipelas was the primary cause of death. If these 18 are deducted from the 38 cases, there remain 20 deaths, or 3.9 per cent, which is fairly comparable to the other figures.

Results in Infants Less than One Year of Age.—Perhaps the greatest value of ultra-violet is shown in the treatment of erysipelas in infants. Erysipelas has always been feared as an extremely fatal disease in small children, with a mortality rate usually reported at from 50 to 75 per cent when treated by the older methods. In this series I have 15 children under one year of age with only two deaths. To this I can add three private cases without a death. This makes 18 cases with only two deaths, or 11.1 per cent.

Dr. Titus reports eight children under one year of age, with two deaths, or 25 per cent. Dr. Jenkins does not state how many patients were under one year of age. However, combining Dr. Titus' and my cases, there are 26 cases with only four

deaths. That is a mortality of only 15.3 per cent in cases of erysipelas in infants under one year of age.

CONCLUSIONS

1. Ultra-violet radiation is an effective treatment for erysipelas.

2. Reports from widely separated sections of the United States: *i.e.*, New York City, Temple, Texas, and Minneapolis, Minnesota, comprising a total of 641 cases, show strikingly comparable results.

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DIAGNOSTIC PNEUMOTHORAX

By SIDNEY SCHNUR, M.D., *New York City*

From the First Medical Division and Department of Radiology, Morrisania City Hospital

INDUCED pneumothorax is recognized as an important therapeutic agent in pulmonary tuberculosis. However, the value of pneumothorax in diagnosis of diseases of the chest has not been emphasized sufficiently and consequently is not generally known. The recent technical advance in chest surgery demands the more widespread knowledge and utilization of all methods for more exact diagnosis.

Air used as a contrast medium in radiology is well established. Pneumography includes such procedures as ventriculography, encephalography, pneumoperitoneum, perirenal injection, double contrast enemas (barium and air), double contrast gastric visualization (barium and effervescent powders), and pneumothorax.

Brauer (1), in 1912, was the first to demonstrate pleural tumors radiographically by injecting air into the pleural cavity. His results and those of Schroeder (8), who reported in 1916, were not encouraging. In 1921, Fishberg (6) introduced this method in America, believing it might be of value in detect ng early lung neoplasms. Caesar (3), Singer (9), Isaacs (7), Faulkner (4, 5), Bromme and others (2) have made contributions to the subject.

INDICATIONS

Pneumothorax has aided in the diagnosis of various chest conditions.

1. *Tumors of the Parietal Pleura.*—These tumors are well outlined because air is an excellent contrast medium which also collapses the lung, allowing an unobstructed view of the parietal pleura. Metastatic carcinoma, mesothelioma, and the various granulomas can be demonstrated. These are commonly associated with a pleural effusion which typically is serosanguinous. After the fluid has been removed and air injected, x-rays are taken with the patient in that position which allows the fluid to gravitate away from the suspected area. Thus, if anteroposterior plates are taken with the patient in the left lateral recumbent position, the presence of the effusion along the mediastinum will allow a clear view of the parietal pleura of the right chest. The diaphragm can be visualized if the plates are taken with the patient in exaggerated Trendelenburg position. The entire pleural space can be explored by this method.

2. *Pleural Adhesions.*—The presence of pleural adhesions frequently is responsible for the failure of therapeutic pneumothorax. Air in the pleural cavity makes this complication visible.

Chest surgeons prefer to wait for the formation of pleural adhesions adjacent to a lung abscess before operating. However, it is difficult to know clinically or radiographically when such adhesions have formed. Faulkner (4, 5) performs pneumothorax routinely to determine the presence of adhesions. His classification, treatment, and prognosis of lung abscess depends largely on the x-ray findings following air injection. He believes there is little danger of empyema when the injection is made in an interspace distant from the abscess. However, most surgeons believe this procedure to be hazardous in lung abscess.

3. *Differentiate Intrapulmonary from Extrapulmonary Shadows.*—Although the stereoscope is most helpful in this problem, we have encountered several cases in which it has failed and pneumothorax has been successful. Plates are taken before and after intrapleural injection. Displacement of the shadow is evidence of intrapulmo-

nary pathology. Other factors being equal, the greater the displacement the more peripheral the lesion, and, conversely, a shadow close to the mediastinum will be shifted but slightly. Extrapulmonary shadows (skin, subcutaneous tissue, muscle, rib, parietal pleura), of course, are not displaced by pneumothorax.

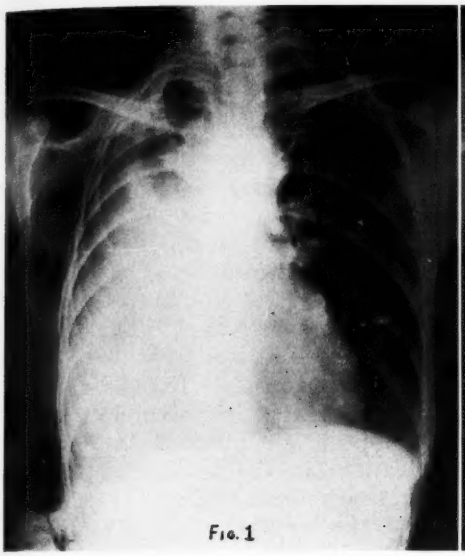

FIG. 1

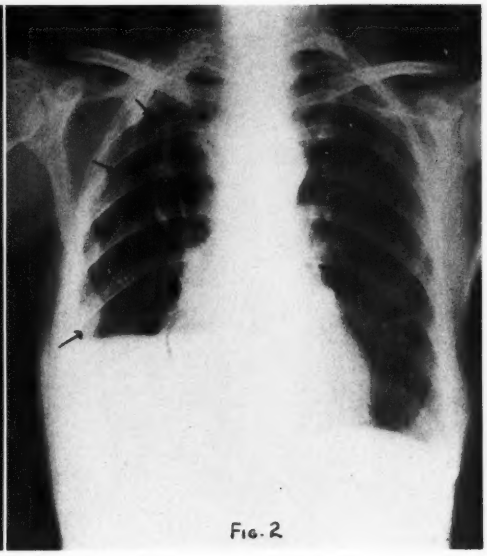

FIG. 2

4. *Fibrin Bodies in the Pleural Cavity.*—Fibrin masses are occasionally seen in the pleural cavity of tuberculous patients who have developed effusions following repeated injections of air. Taylor and Bobrowitz (11) recently reported a series of 125 such cases. Such masses may be removed with the thoracoscope.

5. *Differentiate Pleural, Pericardial, and Mediastinal Effusion.*—Occasionally difficulties arise in the differential diagnosis of a left pleural, mediastinal, and pericardial effusion. The injection of air after aspiration of fluid will more definitely localize the fluid by outlining the serous cavity.

6. *Miscellaneous Conditions.*—Pneumothorax is occasionally used to define more clearly a suspected tuberculous cavity. Snure (10) believed it was of aid in the diagnosis of a mediastinal effusion. It enabled Isaacs (7) to differentiate an interlobar empyema from atelectasis. Singer (9), in two problem cases, outlined a bronchiectatic atelectatic lobe behind the heart shadow. He has also used simultaneously lipiodol and pneumothorax in bronchiectasis.

TECHNIC

The technic, dangers, and complications are similar to those of therapeutic pneumothorax From 300 c.c. to 750 c.c. of air is sufficient in most cases. If a pleural effusion is present, approximately one-third of the volume of fluid removed is replaced with air.

CASES

Case histories are presented herewith, illustrating the diagnostic value of pneumothorax.

Case 1. A white woman, 49 years of age, entered the hospital because of progressive dyspnea, non-productive cough, fatigue, and loss of weight. Thirteen years previously a radical mastectomy of

the right breast had been performed for adenocarcinoma. Her subsequent course was uneventful until two months before the

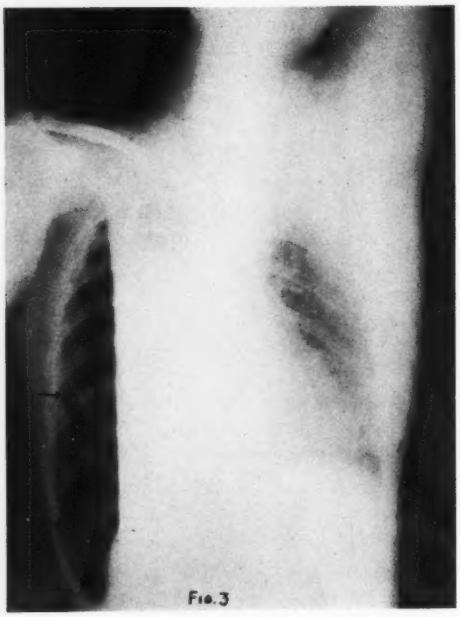

FIG. 3

present admission, when the above-mentioned complaints began. These continued with increasing severity up to the time of admission. Physical examination revealed signs of fluid throughout the entire chest (Fig. 1) and a hard mass in the right parasternal region. There were no subcutaneous masses or axillary nodes.

Thoracentesis of the right chest was performed. Serosanguinous fluid (2,000 c.c.) was withdrawn, and 600 c.c. air was introduced. Anteroposterior plates in the erect (Fig. 2) and left lateral recumbent (Fig. 3) position (the fluid thereby gravitating toward the mediastinum) visualized nodules in the parietal pleura. The pleural sediment, sectioned and stained, revealed clumps of adenocarcinoma. Aspiration biopsy of the right parasternal mass showed adenocarcinoma of the same type and degree of malignancy as that of the pleura.

Comment.—On admission, the patient was suspected of having a latent metastatic carcinoma of the pleura, and parasternal node from the breast, which had been removed 13 years previously. The diagnosis was confirmed by pneumothorax, demonstrating pleural tumors; section and stain of the pleural sediment, disclosing adenocarcinoma, and by aspiration biopsy of the parasternal node.

Case 2. A white woman, 50 years of age, entered the hospital complaining of increasing dyspnea and painless swelling of the right arm. A right radical mastectomy had been done one year previously for adenocarcinoma. Physical examination revealed fluid in the right chest, large right axillary nodes, and lymphedema of the right arm.

Serosanguinous fluid (2,400 c.c.) was removed from the right pleural cavity and 750 c.c. of air introduced. X-ray examinations in the upright and the left lateral recumbent positions revealed nodules in the parietal pleura. The diagnosis of adenocarcinoma was made from the microscopical examination of the pleural sediment.

Comment.—This case is similar to Case 1. Whenever pleural tumors are suspected, or non-traumatic serosanguinous effusions are discovered, air should be injected into the pleura for diagnosis.

Case 3. A white man, 72 years of age, who had had a nephrectomy performed for a hypernephroma five years previously, entered the hospital with incessant nonproductive cough, pain in the right chest, dyspnea, and weakness.

Physical findings were: slight dullness, diminished breath sounds and fremitus, occasional musical râle at the angle of the right scapula, and a palpable immobile deep mass, two inches in diameter, over the left fifth rib in the mid-clavicular line. X-ray examinations revealed a round shadow in the left lung-field, corresponding to the position of the palpable mass, and another in the right lung-field at the level of the fifth rib in the axillary line. The clinical diagnosis was latent hypernephroma metastases to the left fifth rib,

and to either the fifth rib or lung on the right side.

Induced pneumothorax of 400 c.c. of the right chest revealed the shadow to remain stationary while the lung collapsed. This was evidence that the shadow was extrapulmonary—probably in the rib. Postmortem examination verified the clinical impression.

Comment.—Stereoscopic views did not aid in determining whether or not the mass in the right chest was in the rib. Diagnostic pneumothorax excluded the possibility of its being a pulmonary metastasis because its position did not shift with collapse of the lung.

Case 4. A white woman, 52 years of age, entered this institution with indefinite history of fatigue and loss of 30 pounds in three months. Physical examination was negative except for evident loss of weight. X-ray examination of the chest showed a round shadow, one inch in diameter, in the right pulmonary field. Intravenous skiodan revealed flattening of the left upper calyx, suspicious of hypernephroma. Successive pneumothorax injections of the right chest, totalling 750 c.c. of air, caused a displacement of the shadow.

Comment.—In contradistinction to Case 3, this hypernephroma metastasized to the lung rather than to the rib. Pneumothorax revealed the lesion to be extrapulmonary in Case 3 and intrapulmonary in this case.

Case 5. A white man, 32 years of age, entered the hospital with a history of tuberculosis for one and one-half years. Pneumothorax was induced at that time, following which he had many refills. X-ray examination revealed a hydropneumothorax and fibrin bodies in the right cavity.

Comment.—Pneumothorax is of etiological and diagnostic importance in this instance. The repeated therapeutic use of pneumothorax is occasionally responsible for the formation of a pleural effusion. Fibrin bodies are sometimes found in the pleural cavity of these patients. The pneumothorax itself is of diagnostic aid in making these masses visible.

SUMMARY

1. A short history of the use of diagnostic pneumothorax is given.

2. The indications and technic of the method are described.

3. Case histories are presented and relevant comments are made.

Acknowledgment is made to Samuel F. Weitzner, M.D., of Morrisania City Hospital, and Bernard Ehrenpreis, M.D., of Kings County Hospital, for their technical assistance and helpful suggestions.

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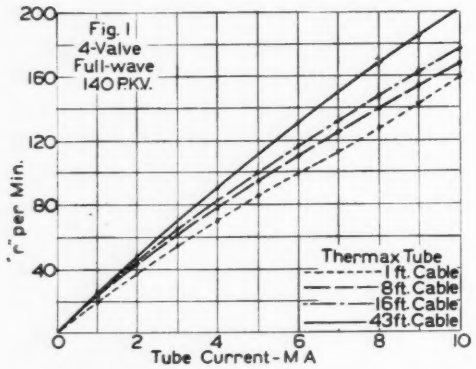
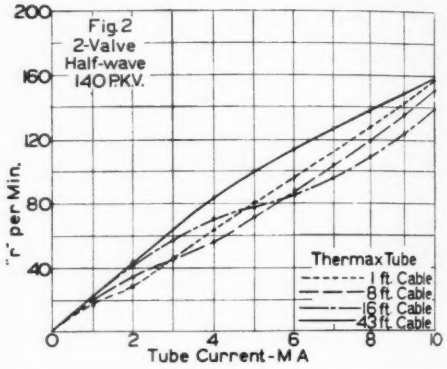
EFFECT OF CABLE LENGTH ON RADIATION OUTPUT OF SHOCK-PROOF X-RAY TUBES

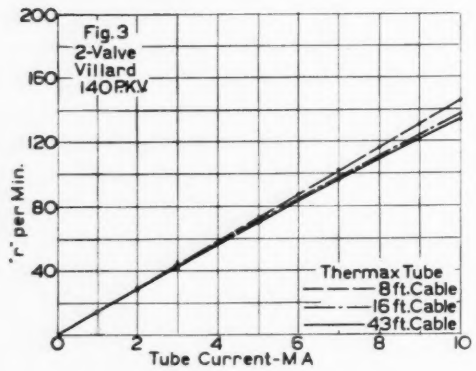
By T. H. ROGERS, M.E.E., Field Engineer, Machlett Laboratories, Inc., *Springdale, Conn.*

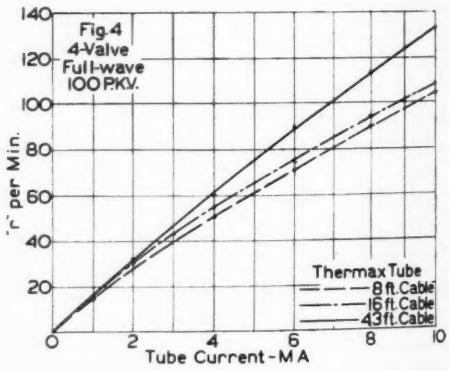
THE rapidly increasing and already widespread use of shock-proof tubes of the cable type for roentgenological purposes gives importance to a consideration of the effect of the capacitance represented by various lengths of shock-proof cable on the radiation output of such tubes. This report presents the results of a series of tests which give some definite indications of how the length of cables employed may affect output under a considerable variety of conditions, and certain conclusions which it is possible to draw from these tests.

The tests consisted largely of measurement of r output from an oil-immersed shock-proof tube of the Machlett Thermax type under various conditions of cable length, load, and type of energizing circuit. The generator for energizing the tube consisted of a Kelley-Koett Type GA transformer, of 50 ma., 200 kv.p. capacity, continuous rating, specially equipped with a flexible arrangement of valve tubes which can be connected so as to produce various types of rectified and unrectified circuits at will, with the exception of the Villard circuit. Measurements were also taken with the tube being operated on a Waite and Bartlett 30 ma., 200 kv.p Villard circuit therapy generator.



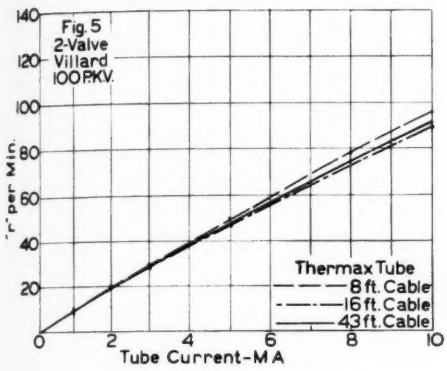


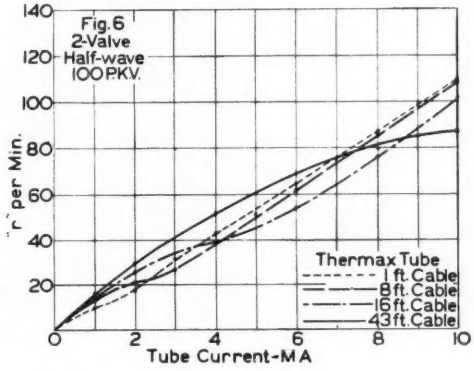


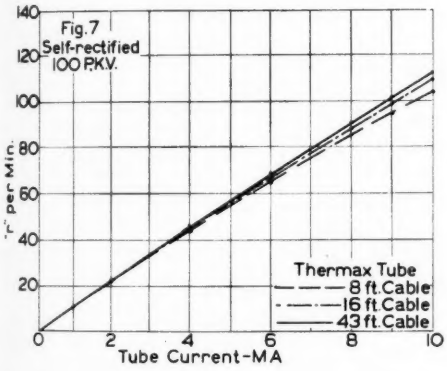


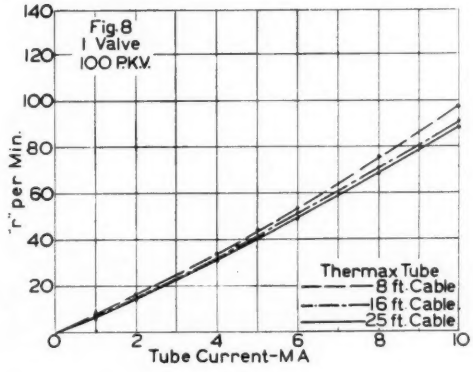
Readings of r output were taken as a

function of milliamperage through a range from zero to 10 ma., at 140 kv.p. on circuits of the 4-valve full-wave, 2-valve half-wave, and Villard types, respectively, and at 100 kv.p. on these circuits and also on any of the sets of conditions involved, since various other factors which are peculiar to any individual installation will further influence this value. However, the results can readily be interpreted









single-valve and self-rectified half-wave circuits, the voltage rating of the tube being inadequate to permit employing 140 kv.p. with the two latter types of circuits. Various cable lengths were employed under each condition. All r measurements were made with a Victoreen condenser type r meter, at 40 cm. focal distance, in air, without cones, and except where otherwise noted, without external filtration.

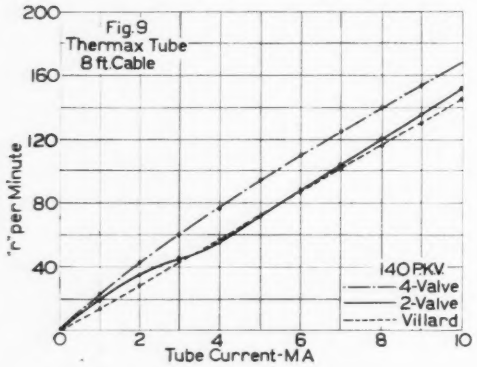
The r output values obtained under the various conditions are given in detail in Figures 1 to 8.

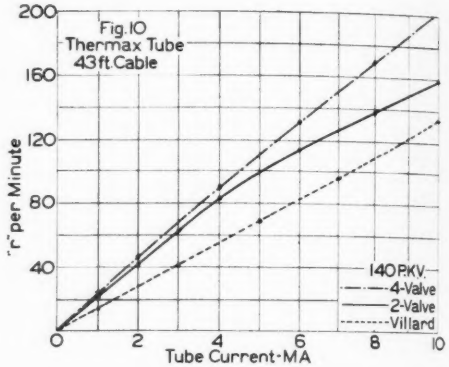
These tests do not attempt to establish quantitatively the output obtainable under any of the sets of conditions involved, since various other factors which are peculiar to any individual installation will further influence this value. However, the results can readily be interpreted to indicate qualitatively how the length of cables will influence the intensity of radiation output under various operating conditions within the range covered. The particular generators used in these tests have very large capacities in comparison with the loads employed, so that effects associated with the loading characteristics of the machines and heating of the transformers are largely eliminated. The tube which was used employs cables having a capacitance of approximately 60 mmf. per foot. The lengths indicated are length of each cable, two being employed in all cases. This tube has an inherent filtration value approximately

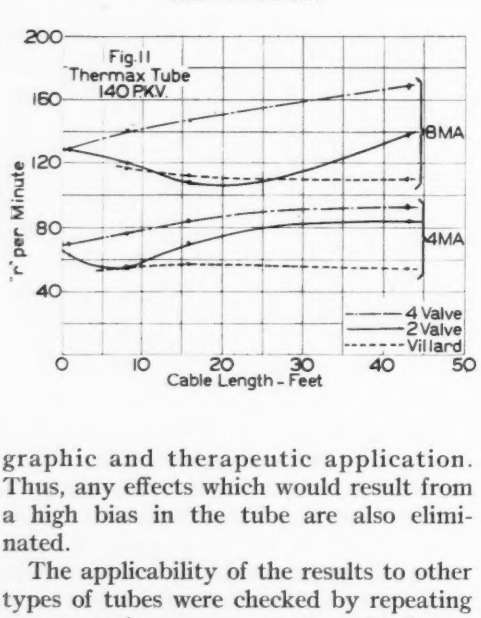
equivalent to about 0.6 mm. of aluminum. The inherent "bias" in the Thermax is relatively low, being equivalent in this respect to the usual radiographic tube, although it is designed for both radiographic and therapeutic application. Thus, any effects which would result from a high bias in the tube are also eliminated.

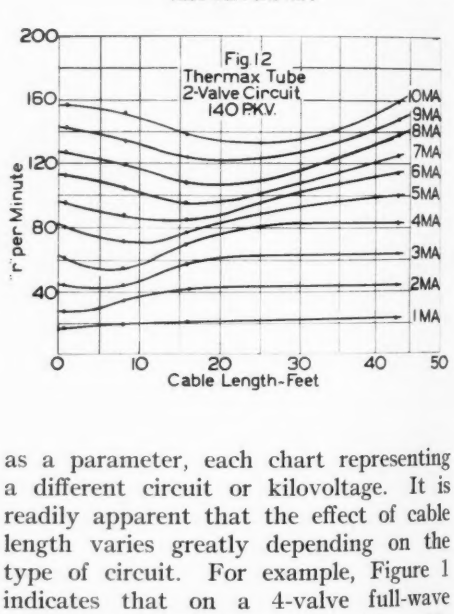
The applicability of the results to other types of tubes were checked by repeating representative measurements, at 100 kv.p., using a radiographic tube (Machlett type CYR) and an air-cooled, bulb-type, light-therapy tube (type XLT), with cables of various lengths connected to the tubes. Results for identical conditions checked those obtained with the Thermax tube within reasonably close limits, indicating that conclusions based on the data presented in this report are qualitatively applicable to tubes of other types as well as the type employed in these tests.

Discussion of Results.—In the charts of Figures 1 to 8, output is plotted as a function of milliamperage with cable length as a parameter, each chart representing a different circuit or kilovoltage. It is readily apparent that the effect of cable length varies greatly depending on the type of circuit. For example, Figure 1 indicates that on a 4-valve full-wave generator output increases with cable length at all values of milliamperage within the range of the test; Figure 3 indicates that output varies only very slightly with cable length in the case of the Villard circuit generator, and from Figure 2, it is seen that on the 2-valve half-wave generator the effect of cable length depends largely on the value of milliamperage. Figures 4, 5, and 6 give similar









indications for the three respective types of circuits at 100 kv.p., Figures 1, 2, and 3 being for 140 kv.p., Figures 7 and 8 indicate that cable length has little influence on r output on self-rectified and single-valve circuits.

The data obtained from these tests may also be plotted in other forms so as to show more clearly other comparisons which may be drawn among the various operating conditions. A chart such as Figure 9 will show the relative efficiencies of various types of circuits. However, the conclusions drawn from such a chart can be valid only for the one value of cable length, since a similar chart for a different length of cables may give an entirely different indication. In Figure 9, which applies to a cable length of eight feet, it appears that the 2-valve half-wave and the Villard circuits are practically identical in efficiency at most values of milliamperage, with the 4-valve full-wave circuit showing a somewhat higher efficiency. With cables 43 feet long, as shown in Figure 10, a very considerable divergence in the efficiency of the three circuits appears, the 4-valve circuit giving the highest output, the 2-valve circuit somewhat lower, and the Villard circuit lowest of all.

The influence of cable length on output can be most clearly shown by plotting r per minute as a function of cable length. Such charts should be made for each milliamperage value of interest, as the effect of cable length varies with milliamperage on some circuits. Figure 11 shows curves of this kind for three circuits at 4 ma. and at 8 ma. These charts show that output increases with cable length on the 4-valve circuit, varies very little with cable length on the Villard circuit, and varies in a rather interesting manner, as discussed in the second paragraph below, on the 2-valve circuit.

Another method of comparing the efficiencies of the various circuits is to reduce the output values to terms of r per minute per ma., plotting charts such as Figures 13 and 14 for various values of cable length. The variation in efficiency with milliamperage for the various operating conditions is most clearly shown by means of such charts.

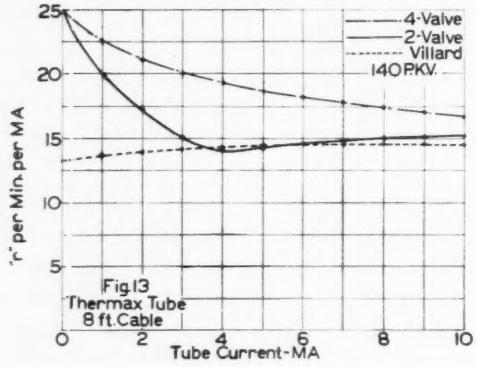
Probably the most interesting phenomena exhibited by these tests are the variation in output with cable length on the 2-valve circuit and the relation between the 2-valve and 4-valve circuits in this respect. Figures 2 and 6, taken together, clearly show that on the 2-valve circuit cable length influences output to a very great extent, but whether any given change in cable length will increase or decrease output depends on both milliamperage and kilovoltage of operation. The variation in output with both cable length and milliamperage at a fixed kilovoltage can be shown in an interesting manner by a chart such as Figure 12, giving values of r output as a function of cable length with milliamperage as a parameter. It can thus be seen that, as cable length is increased, output decreases, reaches a minimum, and then increases with further increase in cable length, tending toward a value considerably higher than the starting point. The cable length at which the minimum output occurs varies with milliamperage, being greater for higher values of milliamperage. These variations are of such magnitude that it may be observed, for example, that the output at 6 ma. with 43-foot cables is higher than the output at 8 ma. with 16-foot cables.

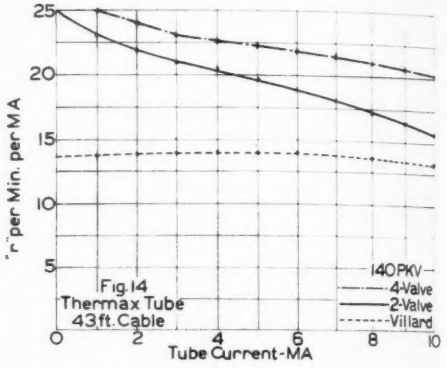
The reasons for these perhaps surprising effects become quite obvious from an analysis of the usual 2-valve circuit to which capacitance as represented by the cables has been added. Such a circuit is shown schematically in Figure 17. The voltage output of such a circuit with zero value of capacitance would theoretically have the form indicated in Figure 18-*A*. With successively greater values of capacitance, the voltage wave will assume in turn the forms indicated in Figures 18-*B*, 18-*C*, 18-*D*, and 18-*E*. Figure 18-*C* represents the condition which results in the minimum output for any given value of milliamperage. Figure 18-*B* corresponds to a smaller

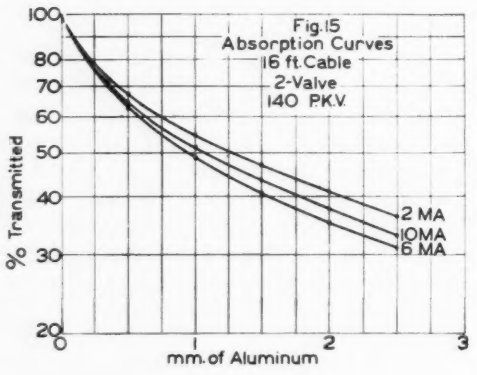
value of capacitance than 18-*C*, Figure 18-*D* to a somewhat larger value than 18-*C*, and Figure 18-*E* corresponds to a very large value which is sufficient to maintain the voltage practically constant, producing the condition resulting in maximum output. The value of capacitance necessary to produce any of these conditions will obviously vary with the milliamperage drawn by the tube, which accounts for the fact that the point of minimum output varies with milliamperage.

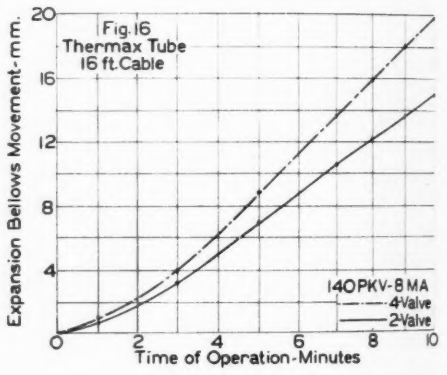
It is strikingly evident that this circuit is most inefficient in the range of cable length and milliamperage usually employed for superficial and intermediate therapy applications. Figure 12 immediately suggests that this efficiency can be greatly increased by adding additional capacitance to the circuit, which might be in the form of condensers connected so as to add to the capacitance of the cables.

The results obtained with the 4-valve circuit appear to be quite different from those of the 2-valve circuit. Here output increases steadily with increase in cable length throughout the range of milliamperage from zero to 10 ma. However, it would be necessary to considerably extend the milliamperage range to fully check the action of the 4-valve circuit in this respect. It can be observed that the action of the 2-valve circuit between zero and 2 ma. is quite similar to that of the 4-valve circuit between zero and 10 ma. If the range were extended to, say, 50 ma., it is entirely possible that effects similar to those observed with the 2-valve circuit would occur with the 4-valve circuit. Milliamperages of this order being in the radiographic range, an investigation of this nature for 4-valve full-wave circuits would be of interest in relation to the influence, if any, of the capacitance of different lengths of shock-proof

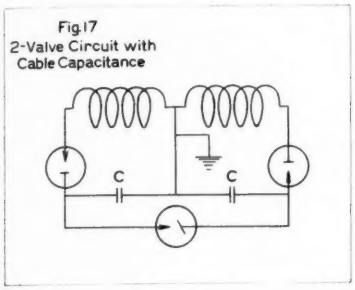


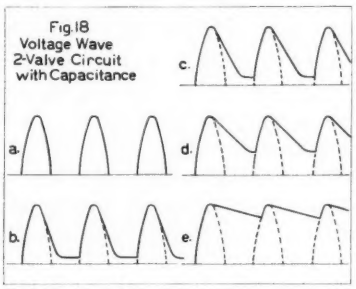






cables on the radiographic effect at various kilovoltage and milliamperage factors. If such variations in intensity are appreciable, they would have a bearing on the proper technics to be employed for any desired radiographic results.





With the Villard, single-valve, and self-rectified circuits, no considerable effect of cable capacitance on output is observable. While at first thought it might be expected that these results would be in general similar to those with the 2-valve half-wave circuit, analyses of the respective circuits show that in the 2-valve case, the charge on the cables is discharged through the x-ray tube only, whereas in these cases, the cables are able to partly or wholly discharge back into the generator, the discharge not being blocked by valve tubes.

In view of the fact that the variations in output noted above appear at both 140 kv.p. and 100 kv.p. in the same general manner, it seems likely that similar variations will occur at higher voltages. Hence, the results of these tests also give some indication of the effect of cable capacitance on output to be expected in shock-proof deep therapy installations employing these various circuits.

Variations in quality as well as quantity of radiation would also be expected under the various conditions involved. Absorption curves for typical conditions throughout the range represented by these tests would indicate the nature of such variations. To bring out an interesting fact, aluminum absorption curves were taken on the 2-valve circuit, with 16-foot cables at 140 kv.p. for three different values of milliamperage. These curves are shown in Figure 15. At 2 ma., the half value layer is 1.3 mm.; at 6 ma., 0.95 mm.; at 10 ma., 1.07 mm. Thus a very considerable change in quality is effected merely by changing the milliamperage under such conditions.

There is also the question of energy input to the tube under the various conditions. It would be expected that at a given kilovolt peak and milliamperage load, a condition giving the higher r output would subject the tube to a higher thermal load. This point was checked for the 2-valve and 4-valve circuits at 8 ma. and 140 kv.p. load, 16-foot cables being employed in both cases. The method of comparing thermal input consisted of measuring the movement of the expansion bellows. In both cases the tube was operated for ten minutes, starting at room temperature, with the normal flow of cooling water turned off entirely, and the position of the bottom of the expansion bellows was noted at the beginning and end, and at intervals during the run. Movement of the bellows, in millimeters, is shown in Figure 16 as a function of time. The relative position at the end of ten minutes indicates approximately a 30 per cent greater thermal input for the 4-valve circuit. A comparison between Figures 1 and 2 for the same conditions shows approximately a 40 per cent higher r output for the 4-valve circuit. Thus, it would appear that the increase in r output is accompanied by a somewhat

lesser increase in thermal input. A greater gain in efficiency in such cases would probably be apparent if added filtration is used with the tube, since there would be less absorption in the filter when the condition giving the higher r output was employed.

SUMMARY

The tests made permit drawing the following qualitative conclusions:

When an x-ray tube equipped with shockproof cables is operated at the load factors customary for superficial and intermediate therapy, the effect of the cable capacitance depends upon the type of circuit employed in the generator. In general, if the circuit is of the 4-valve full-wave type, the r output of the tube will be considerably increased as a result of the addition of the cable capacitance; in the case of a 2-valve half-wave circuit, the r output may be either increased or decreased, depending to a very marked degree on the milliamperage and voltage factors and the exact value of cable capacitance. Cable capacitance has very little effect in the case of Villard circuit, single-valve, and self-rectified generators. No tests were made on mechanically rectified generators.

The results of these tests suggest the possibility of some effects at radiographic loads with a 4-valve full-wave circuit which may have important bearing on radiographic results under such conditions. Further investigation of such conditions is indicated.

The results of any comparison of the relative efficiencies of different types of generators depend very much on the length of cables employed. With a 2-valve half-wave generator, cables of the usual length are likely to result in a relatively very inefficient condition in regard to r output. The results of these tests lead to the suggestion of connecting additional capacitance in the form of condensers across the terminals of such a generator to increase the output.

Quality of radiation also appears to be influenced by cable capacitance. This factor was not fully investigated, but it is indicated that conditions which produce higher values of output per ma. also produce radiation of greater penetration as evidenced by greater half value layer of aluminum.

Thermal energy absorbed by the tube at a given milliamperage and peak kilovoltage load also varies with conditions involving cable capacitance. It is indicated that conditions producing higher r output also involve a greater thermal load on the tube, but the increase in output is greater than the increase in thermal load.

THE USE OF ROENTGEN THERAPY IN THE CAROTID SINUS SYNDROME[1]

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From the Department of Radiology, Scott and White Clinic

IT is the purpose of this paper to present five cases in which roentgen therapy has been used for the treatment of the carotid sinus syndrome. Radiologists have irradiated the autonomic nervous system for various pathologic conditions, but as a whole the results have been discouraging, and many look upon roentgen therapy in this field with considerable skepticism.

For many years physiologists have been interested in the slowing of the heart rate which can be induced by pressure over the vagus nerve. All authors now give credit to Hering for demonstrating the true nature of this reflex. He showed that this reflex arose as a result of pressure over the carotid sinus with its rich supply of autonomic nerve fibers.

The carotid sinus is a bulbous dilatation of the internal carotid artery at its point of origin from the external carotid artery. Some variation in its location has been described but it is always in close relationship to the area where the internal and external carotids arise from the common carotid artery. One point of practical interest to the radiologist is that this bifurcation may be located at various levels in the neck from just above the angle of the jaw down to the thyroid gland. Most commonly, however, it is located just below the angle of the jaw.

The wall of the sinus is thinner than the adjacent parts of the artery owing to a decrease in the size of the media. The adventitia is richly supplied with sensory receptors. This network of nervous tissue leaves the carotid sinus as the sinus nerve. The most direct connection is with the glosso-pharyngeal nerve. The vagus and superior cervical ganglia are also connected with the sinus nerve. Some investigators claim there is a connection with the hypoglossal nerve.

It has been conclusively demonstrated that the nerve impulse arising from the carotid sinus can be due to stretching or distention of the sinus from within or by pressure on the outside of this area. The impulses travel centrally to the medulla, and from the medulla the efferent pathways may be along the vagus and vasomotor depressor nerves to the periphery or to the cortex by the way of the thalamic region.

The carotid sinus syndrome may be bizarre or consist simply of syncope of varying duration. It is usually possible to explain the symptoms on the basis of the efferent pathways, either to the periphery or to the cerebral cortex. Usually three reflex areas may account for the clinical picture: a vagal reflex resulting in cardiac slowing or standstill; a vasomotor reflex resulting in a fall of blood pressure; or a cerebral reflex which may cause syncope without significant changes in pulse rate or blood pressure.

Etiology.—Sigler found that arteriosclerosis and hypertensive heart disease were common in a large group of patients who had cardiac slowing on pressure over the carotid sinus. He showed also that the reflex slowing of the heart by carotid sinus pressure is more common in males than females and that it is more frequent in the older-age groups.

Weiss and his co-workers reported a large group of cases and found local disease of the sinus in many instances. Dilatation or sclerosis of the sinus and cervical adenitis were common, and general constitutional disease existed in some of these patients.

Clinical Manifestations.—Attacks of unconsciousness, with or without convulsions,

[1] Read before the Texas State Radiological Society, Oct. 22, 1938, at San Antonio, Texas.

occurring at varying intervals is the most common complaint. Smith and Moersch reviewed a series of these cases and concluded that the attacks may be characterized by light-headedness, ringing in ears, blurring of vision, and numbness of extremities. Objectively, there may be pallor, sweating, dilatation of the pupils, exophthalmos, slowing of the pulse rate, and cardiac standstill.

The attacks usually come on while the patient is in an upright position and may be relieved by lying down, if the promontory symptoms are of sufficient duration. The attacks may be precipitated by sudden movements of the head and neck or by pressure or blows on the neck. General constitutional disorder, such as emotional upsets, fatigue, and menstruation, may be a predisposing factor.

Treatment.—Any obvious local or systemic disease associated with the carotid sinus syndrome should be treated. Specific drug treatment has been based on the type of reflex causing the symptoms. A drug with the proper physiological action is chosen to interrupt the abnormal reflex. This drug therapy has not been of great value in prophylaxis.

Surgical denervation of the carotid sinus has been done with good results. The operation is not without hazard however.

In hope of affording some relief to these patients with a hypersensitive carotid sinus, roentgen therapy was used as the only specific type of treatment in the following five cases.

Case Reports.—Case 1. R. T., white man, 37 years of age, entered the clinic on Dec. 3, 1937, with a chief complaint of "blank spells." His first attack came on one month before admission and was characterized by a loss of consciousness for about one minute. There were no convulsions, but after he regained consciousness he noticed a tachycardia. After his heart rate subsided to normal he developed a generalized headache. The patient experienced two more of these attacks before entering the clinic.

All laboratory examinations were essentially negative and physical examination did not disclose any disease or abnormality except in regard to the carotid sinus. It was possible to exactly duplicate the patient's attacks by moderate pressure over the carotid sinuses. A diagnosis of hypersensitive carotid sinus was made and roentgen therapy was given to both sides of the neck.

The patient returned for observation on Jan. 17, 1938. He had had no attacks since his treatment with x-ray. It was impossible to reproduce his attacks by pressure over the carotid sinuses. In hope of added prophylaxis, a second course of roentgen therapy was given. The patient was again seen on June 21, 1938. He had been feeling perfectly well and had not had any attacks. It was impossible to demonstrate a hypersensitive carotid sinus at that time. The patient was last heard from on Oct. 10, 1938. He had had no attacks up to the time of that communication.

Case 2. G. M., white man, 27 years of age, entered the clinic on Jan. 7, 1938, with a chief complaint of "fainting attacks." He gave a history of having his first fainting spell two years before admission. This attack was characterized by dizziness, marked blurring of vision, and mental confusion. He did not entirely lose consciousness. There were several of these attacks during the first year, but in the year before admission they had decreased slightly in number but not in severity.

All laboratory data were essentially negative. Physical examination showed no evidence of disease or abnormality except in regard to the carotid sinuses. It was possible to reproduce the patient's attack by moderate pressure over the carotid sinuses, and a diagnosis of hypersensitive carotid sinus was made and roentgen therapy given.

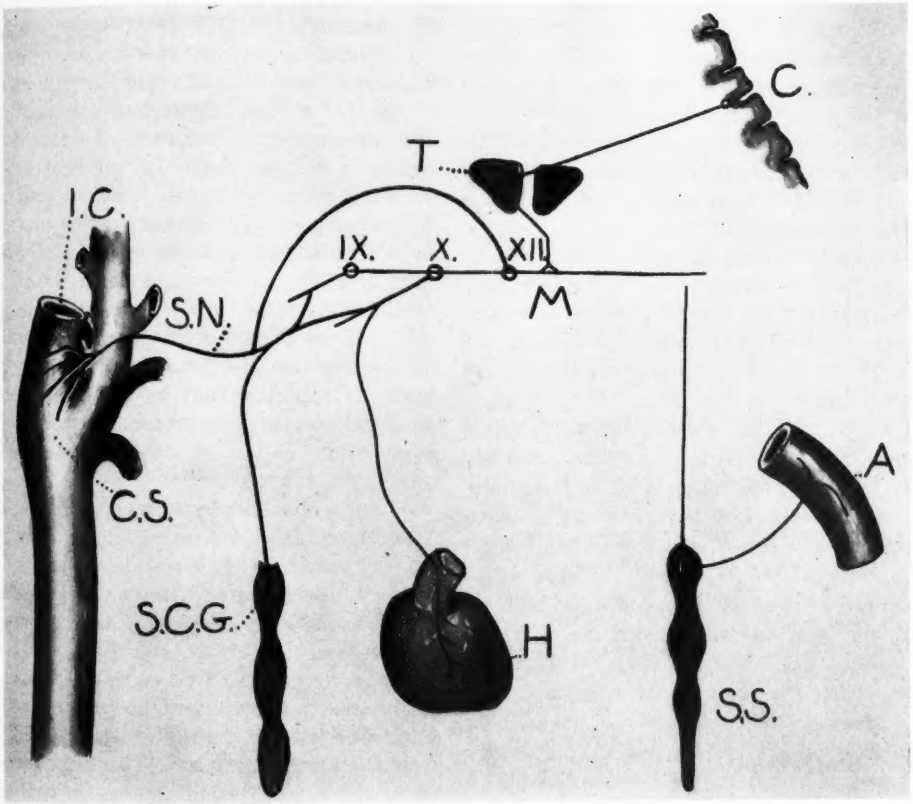
The patient returned on Feb. 10, 1938, giving a history of having had no attacks since the previous admission. It was impossible to reproduce his attacks by pressure over the carotid sinuses. A second

course of roentgen therapy was given and the patient then was dismissed. When last heard from on Oct. 11, 1938, he had had no attacks and was feeling fine.

Case 3. B. H., white man, 28 years of age, entered the clinic on Jan. 26, 1938, with a chief complaint of "fainting spells." He had had these attacks over a period of 10 or 12 years and at extremely varying intervals. The attacks were always characterized by a feeling of fullness in the head, blurring of vision, and inability to speak. Consciousness was not lost, and there were no cardiac symptoms. The last attack, two weeks before admission, was preceded by his usual symptoms; but there then followed unconsciousness and convulsions for a few minutes.

The results of all laboratory tests were essentially negative, and there was no clinical evidence of disease other than the hypersensitive carotid sinuses. Pressure

THE CAROTID SINUS AND ITS RELATIONSHIP TO THE AUTONOMIC NERVOUS SYSTEM



I. C.—Internal carotid artery; C. S.—Carotid sinus; S. N.—Sinus nerve; S. C. G.—Superior cervical ganglia; IX—Glosso-pharyngeal nerve; X—Vagus nerve; XII—Hypoglossal nerve; M.—Medulla oblongata; H.—Heart; T.—Thalmus; C.—Cerebral cortex; S. S.—Sympathetic system; A.—Arterioles.

moderately applied to both carotid sinus areas duplicated the patient's last attack. An electrocardiographic tracing made at the same time that pressure was applied showed a slowing of the pulse and a period of complete asystole for 2.1 seconds. The blood pressure dropped from 120 to 100 mm. of mercury systolic during the period of cardiac slowing. A diagnosis of carotid sinus syndrome was made and roentgen therapy given.

The patient returned on March 3, 1938, with a history of having had two mild attacks a few days before readmission. The attacks could be reproduced by pressure over the carotid sinus, and a second course of roentgen therapy was then given. The patient returned for observation on May 13, 1938. He had had one attack of fairly severe intensity about three weeks before. His attacks could be reproduced, and a third course of roentgen therapy was given. The patient has felt well since his last treatment and was last heard from on Oct. 10, 1938. He had had no attacks up to that time.

Case 4. M. S., white woman, 60 years of age, first entered the clinic on June 24, 1922, with a chief complaint of "fainting spells." At that time it was difficult to account for these spells for no abnormal changes could be elicited. The cardio-vascular system was essentially normal, and the patient was placed on digitalis therapy. She was next seen on May 13, 1938, with the same chief complaint she had given in 1922. There had been many attacks over this 16-year period. The only symptoms had been dizziness followed by fainting. Recovery promptly ensued when she was in a reclining position.

All laboratory examinations were within normal limits. The blood pressure was 150 mm. of mercury systolic and 70 mm. of mercury diastolic. There were no other cardio-vascular observations of importance. Pressure moderately applied over both carotid sinuses duplicated her attacks. Roentgen therapy was given, and when the patient was last heard from on Oct. 1, 1938, she had had no attacks since receiving treatment.

Case 5. R. M., white man, 66 years of age, entered the clinic on Aug. 1, 1938, with a chief complaint of "dizzy spells." These spells had occurred at varying intervals during the past five years but had become more frequent and severe during the past two years. The attacks consisted of vertigo and blurring of vision lasting from about 10 to 15 minutes. Sudden changes in position of the head seemed to cause the attacks.

The results of laboratory studies were within normal limits. A roentgenogram of the chest showed marked calcification and torsion of the arch of the aorta. The patient's attacks could be duplicated by pressure over the carotid sinuses, and an electrocardiographic tracing made at the same time the pressure was applied showed slowing of the cardiac rate and a period of complete asystole for five seconds.

Roentgen therapy was given, and when the patient was last heard from on Oct. 12, 1938, he reported that he had been completely free from his former attacks.

DISCUSSION

Many cases of hypersensitive carotid sinus have been reported; hence the five cases reported here are not described in detail. A more thorough clinical description of this entity may be found in the literature reviewed in this study.

In each of these five cases the attacks that caused the patient to come to the clinic have been reproduced by pressure over the carotid sinuses. The same physician who originally examined the patient attempted to duplicate the attacks after roentgen therapy was given.

Pfahler has mentioned that roentgen therapy of the sympathetic nervous system probably does its good because the ganglia are inflamed or hypersensitive.

Langer reported many cases in which roentgen therapy was given over various sympathetic nerve centers. He has stated that the results have been due to a depression of the sympathetic ganglia. He used

a fairly hard ray obtained with 200 kv. and 0.5 mm. of Cu as filter.

Kremer and Laplace report a case of heart block following roentgen therapy for thyrotoxicosis. They evidently used a very small amount of radiation and claim that the heart block was due to a sensitization of the carotid sinus by roentgen therapy.

Following the dictates of the Arndt-Schutz law[2] all five cases reported here were given a moderate dose of roentgen therapy with the expectation of inhibiting or lessening the sensitivity of the nervous tissue around the carotid sinus.

The technical factors used are 165 kv. (constant potential), 0.5 mm. of copper and 1 mm. of aluminum as filter, and 50 cm. target-skin distance. A 10 × 10 cm. cone was centered over the area in the neck where the clinician was able to reproduce the attacks by pressure. Five hundred r (measured in air) were given in a single dose to one side of the neck. The next day the same dose was given to the opposite side.

When the therapy was repeated at a later date the same technical factors and dosage were used. There were no systemic reactions, but a mild parotitis was noticed by all patients. This subsided in a day or two.

In this small group of cases, one patient required three courses of roentgen therapy to accomplish the desired results. The remaining four responded to one course of treatment.

This group of cases is too small to give any definite statistics, and no definitive conclusions may be drawn. To date, there seems to have been actual prophylactic value to the roentgen therapy. The actual duration of this beneficial action remains to be seen.

Smith and Moersch state that drug therapy is not satisfactory for prophylaxis. Surgical denervation of the carotid sinus is a technically difficult procedure, and the operation is not without danger for the wall of the sinus is quite thin. Roentgen therapy, in the hands of a capable radiologist, can do no harm in this condition.

I hope that this report will stimulate interest in radiation therapy of properly selected cases of the carotid sinus syndrome.

[2] In brief this law states that small doses of radiation stimulate tissue, moderate doses inhibit, and large doses destroy.

CONCLUSIONS

1. Five cases of carotid sinus syndrome are reported, in which roentgen therapy has been the sole specific treatment.
2. Roentgen therapy seems to afford definite prophylactic value in this small group.
3. No mention can be found in the literature of the use of roentgen therapy in this syndrome.

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MEDIAN RHOMBOID GLOSSITIS

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THE total number of cases represented in this survey of the literature on the subject is 54. In addition, the lesion is briefly discussed in several textbooks on dermatology and some of the treatises on diseases of the mouth and tongue. (See bibliography 25 to 33, inclusive.)

Review of Literature.—In 1906, Brocq (1) first mentioned this interesting lesion in a brief paragraph, but it was not until 1914 that he and Pautrier described in detail 17 cases of "glossite losangique médiane de la face dorsale de la langue." Since then, several authors have contributed case reports, all crediting Brocq and Pautrier (2) with the distinction of being the first to recognize this lesion as a separate entity, not to be confused with lingual manifestations of syphilis, tuberculosis, or neoplasm.

Three months after Brocq and Pautrier's original contribution, Jourdanet (3) reported a single case and emphasized the importance of distinguishing this lesion from other lesions of the tongue. In his patient the lesion existed coincidentally with syphilis. In the same year Dubreuilh (4) reported two cases in syphilitics and stated that most of those who encountered the lesion thought it to be a manifestation of syphilis. The first patient came to Dubreuilh, in 1894, for the treatment of syphilis. The lesion did not respond to antisyphilitic therapy and 20 years later its appearance remained unchanged. The second patient asserted that the lesion had been present at least 12 years prior to its discovery by Dubreuilh and that it had not changed during that time. Balzer and Galliot (5) presented a patient with a peculiar X-shaped lesion of the tongue which Pautrier, in discussion, stated was not the type described by Brocq and himself. On the other hand, de Azua (6) described a typical lesion but called it tuberculosis.

Sanz de Grado (7) in 1916, Arndt (8) in 1921, Léorat (9) and May (10) in 1922, and Lane (11) in 1924, independently reported single cases. The two cases of "a hitherto undescribed condition of the tongue," reported by Fordyce and Cannon (12) shortly before Lane's report, probably were examples of the nodular form of the lesion. Siemens (13) described two cases associated with leukoplakia of the buccal mucosa. Barber (14) described a lesion similar to those of Fordyce and Cannon's patients. Ercoli (15) reported four characteristic examples of the lesion and raised the question of their being tuberculids.

Brocq (16) and Kraus (17) each reported single cases in 1927, and in 1928 Zimmerman (18) gave a complete review of the pre-existing literature on the subject. In addition, she described in detail a case that had been briefly presented by Zurhelle (19) two years before. Pautrier (20) also reported an additional case in 1929. Gougerot and Dechaume (21), in 1933, described smooth plaques in various portions of the tongue which they regarded as atypical forms of the lesion. A year later Abshier (22) reported an additional case. In 1934, Loos and Hörbst (23) described one of eight typical cases in detail. These authors made a significant contribution by proposing a theory of origin of the lesion based on a study of the embryology of the tongue. This will be considered later in this communication. Martin and Howe (24) recently added 11 more cases to the literature and corroborated Loos and Hörbst's theory of the etiology. A photograph of an additional case is shown in Prinz and Greenbaum's book (25).

Clinical Aspects of the Lesion.—The lesion is a localized lozenge-shaped, irregularly rhomboid, or oval area of the dorsal surface of the tongue. It is commonly located about one centimeter anterior to the *V* at the apex of the vallate

papillæ, but it may be found considerably further toward the tip of the tongue. The rosy surface is smooth and glistening due to a complete absence of papillæ. It may be dotted with a few nodules of pin-head size. The lesion may be composed of several confluent or rounded nodules or it may be subdivided by fissures into separate smooth-surfaced areas, the characteristic ovoid or rhomboid configuration of the lesion as a whole being preserved (Fig. 2). The dimensions vary from case to case. The long axis always lies in the septum linguæ and measures from one and one-half to three centimeters. The width varies between seven-tenths and one and one-half centimeters, and the surface may be elevated from two to five millimeters above the surrounding mucosa. The lesion is not only visibly demarcated sharply from its surroundings, but palpably also, for it is somewhat firm to the touch in comparison with the adjacent soft lingual tissue.

The lesion is typically asymptomatic and it is usually discovered by chance. In some of the reports, however, it is stated that a vague sensation or sharp pain brought it to the attention of the patient. From a study of the cases in the literature in which the sex of the patient was specifically recorded, it is found that the lesion occurs approximately three times more often in males than in females. The lesion has never been described in an infant. Indeed, the youngest patient reported (Case 2, of Brocq and Pautrier, 2) was 15 years old. One patient, however, stated that she had had the lesion "as far back as she could remember" (the author's Case 1). Although only 54 cases have been reported in the literature, Arndt (8) stated that in a period of 18 months 40 examples of this lesion were observed in the Berlin University Skin Clinic. If patients' tongues were routinely carefully inspected, the lesion might be encountered more often.

Microscopic Characteristics.—The epithelium is devoid of the papillæ ordinarily present in the portion of the tongue occupied by the lesion. There may be considerable hornification of the surface layers, and the cells of the Malpighian layer tend to proliferate downward, forming elongated pegs in the connective tissue. These may branch and anastomose in an epithelial rete. Mitotic figures are absent. The tunica propria is sometimes infiltrated with lymphocytes (Fig. 2-*A*). This infiltrate is most abundant near the epithelium, where there is also an increase in collagenous connective tissue. Blood vessels and lymphatics are numerous, forming extensive capillary networks in the tunica propria. In some cases there is degeneration and hyalin formation in the striated musculature of the tongue (Fig. 2-*B*). These are the changes ordinarily present in a chronic inflammatory lesion.

Etiologic Considerations.—The etiology of this lesion is unknown. More than half of the cases described in the literature had no associated disease. Syphilis, the use of tobacco, and poor oral hygiene are probably not factors in its causation since leukoplakia, a frequent concomitant of intra-oral irritation, is notably a rare finding, being associated with the lesion in only two of the cases of Brocq and Pautrier (2) and in the two cases reported by Siemens (13). A history of syphilis or a positive serologic reaction is frequent in the cases reported by the French authors (2, 3, and 4), but they emphasize that the lesion is merely a coincidental finding and that it is entirely resistant to antisyphilitic therapy. Lupus erythematosus was present in Case 11 of Brocq and Pautrier (2). Ercoli (15) thought the lesion might be a tuberculid, but presented no convincing evidence to support this theory. None of the cases investigated by the author or by others showed tuberculous or neoplastic characteristics, but microscopic evidence of chronic inflammation is invariably present. Loos and Hörbst (23) interpreted the presence of dilated lymphatics and capillaries as meaning that the lesion was an angioma. These authors and Martin and Howe (24) have attempted to link the lesion with an anomalous persistence of the tuberculum impar. In order to consider this aspect of the etiology it is neces-

sary to turn briefly to the embryology of the human tongue.

According to the textbooks of embryology, the epithelium of the free portion, or body of the tongue, is derived from the paired lateral swellings of the first or mandibular arch. The anlage of the epithelium of the root of the tongue is the copula or "yoke" between the second branchial arches. Between the lateral mandibular swellings in a human embryo of 5 mm. there is a rhomboid depression. From this the tuberculum impar (unpaired tubercle) of His projects dorsally (Fig. 4). Formerly, this was thought to be the chief anlage of the body of the tongue, but in 1901 Hammar (34) stated that it is merely a transitory structure and takes no part in the formation of the human tongue.

Whether or not the tuberculum impar does persist as a part of the adult tongue, it is conceivable that a rhomboid or oval anomaly might be derived from it. Such an anomaly would be likely to lie in the midline somewhere anterior to the apex of the *V* of the vallate papillæ which anatomically separate the body of the tongue from the root. Although this is only *a priori* evidence for the etiology of this interesting lesion, it constitutes a plausible clue to its origin. If the lesion should ever be discovered on the tongue of a premature fetus or a newborn infant, there could be little doubt about its development as a prenatal anomaly.

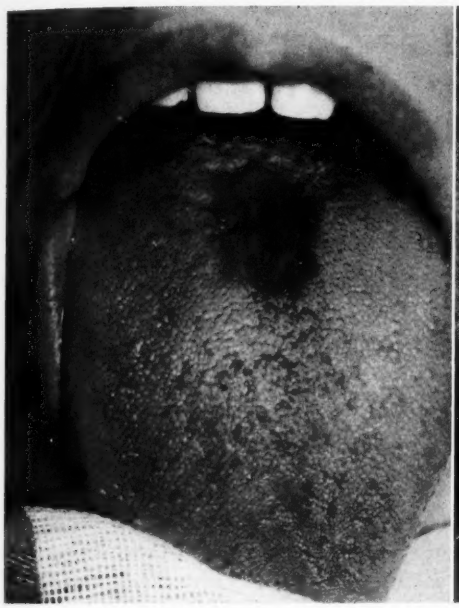

Fig. 1. Case 1.

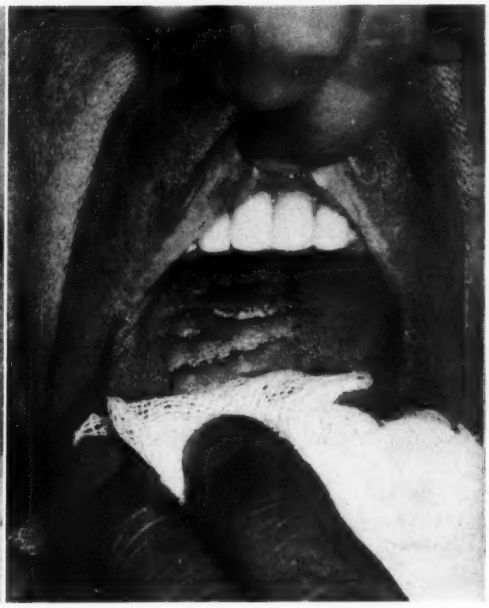

Fig. 2. Case 2.

Diagnosis and Treatment.—The lesion may be recognized from (1) its characteristic location in the median raphe of the dorsum of the tongue, anterior to the vallate papillæ; (2) its roughly rhomboid shape; (3) its rosy color; (4) its smooth, nodular, or fissured surface completely free of papillæ; (5) its slight induration, and (6) its asymptomatic character and chance discovery.

If no symptoms are attributable to it, treatment is not indicated, for it is certainly a benign condition. However, if

it is associated with annoying symptoms, if it gives rise to cancerphobia, or if there is reasonable doubt concerning the diagnosis, excision is advisable. As far as the writer could ascertain, no reports have been made of the effect of radium or x-ray therapy on the lesion.

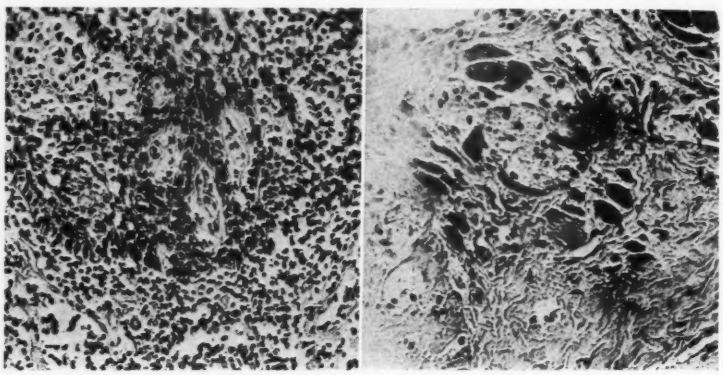

Fig. 2-*A*. Fig. 2-*B*.

Fig. 2-*A*. Photomicrograph from Case 2 showing lymphocytic infiltration of tunica propria and epithelium. (Hematoxylin and eosin.)
Fig. 2-*B*. Photomicrograph from Case 2 showing muscle degeneration and hyalinization. (Hematalum, erythrosin, and saffron.)

CASE REPORTS

Case 1. B. W. M., white nurse, 21 years of age, consulted the author in March, 1936, regarding a lesion on her tongue which had been present "as far back as she could remember." It had never increased in size, nor had it ever produced symptoms. No member of her family had a similar lesion. She smoked moderately, but she was certain that the lesion had been present many years before she began to smoke.

Examination showed a rosy-red superficial lesion of hexagonal contour on the dorsal surface of the tongue, 1 cm. anterior to the lingual *V* (Fig. 1). It was elevated about one millimeter above the surrounding mucous membrane and was firmer than the adjacent normal lingual structures. Its surface was smooth and glistening and its edges were clear-cut. The long axis lay in the midline of the tongue. The dimensions were 1.8 cm. × 1.3 cm. The Wassermann and Kahn reactions were negative. No biopsy was taken. The author saw the patient two years later, several months after the termination of a normal pregnancy. The lesion had not changed.

Case 2. B. G., white male, 60 years of age, a native of Czechoslovakia, was seen in the out-patient department of the University of Chicago Clinics in April, 1938, because of a chest complaint. During an E.N.T. examination a hard lesion on the dorsal surface of the tongue was discovered (Fig. 2). It was 3 cm. long × 2.2 cm. wide, had an ovoid shape and a reddish hue, and its long axis lay in the midline of the tongue. It was composed of broad smooth-surfaced elevations from 2 to 3 mm. in height. These were separated by deep transverse fissures. The teeth were carious. The patient denied ever having had syphilis and the serological tests were negative. He had never before been aware of the existence of the lesion. The Wassermann and Kahn reactions were negative.

A biopsy specimen showed a hyperplastic epithelium without evidence of mitotic activity. There was a heavy lymphocytic infiltration. The lymphocytes were most abundant in the lower epithelial layers and in the tunica propria immediately beneath the epithelium (Fig. 2-*A*). Special

stain revealed degenerative changes in the muscle fibers of the tongue (Fig. 2-*B*).

Case 3. G. V. R., white male, 39 years of age, complaining of impaired hearing, was seen in the E.N.T. Department of the University of Chicago Clinics in June, 1938. He was found to have a chronic suppurative otitis media and a typical rhomboid lesion of the tongue. The patient had no previous knowledge of the presence of this lesion.

Examination revealed a reddish, smooth, diamond-shaped, slightly indurated area on the dorsum of the tongue, 1.5 cm. anterior to the lingual *V*. It was elevated 1 mm. and measured 3 cm. × 1.5 cm. with the long axis in the midline of the tongue (Fig. 3). The teeth were in fair condition and the Wassermann and Kahn reactions were negative. The patient smoked moderately. No biopsy was taken.

Case 4. P. Z., white male, 44 years of age, was examined in June, 1938, in the E.N.T. Department of the University of Chicago Clinics because of an external otitis. During the examination a lesion was discovered on his tongue, of which he had previously been unaware. It was in all respects like that of Case 3 except that it was slightly smaller, measuring 2 cm. × 1.4 cm. It lay just anterior to the lingual *V*. No biopsy was taken. The Wassermann and Kahn reactions were negative.

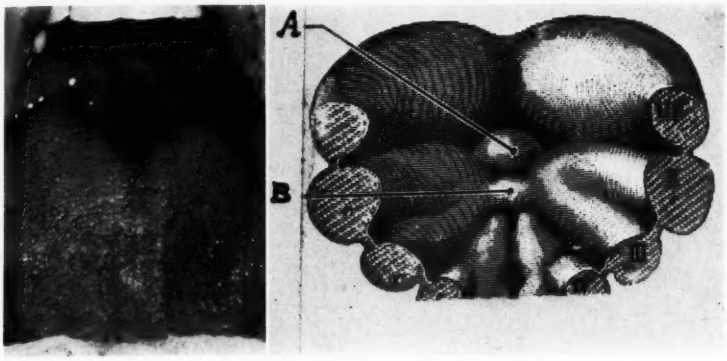

Fig. 3. Fig. 4.

Fig. 3. Case 3.
Fig. 4. Stage of development of tongue in 5 mm. human embryo (from Kollman's Atlas). *A*. The tuberculum impar. *B*. The copula. *UK*, *II*, *III*, and *IV*. First four branchial arches.

COMMENTS AND CONCLUSIONS

The origin of this lesion still remains a source of speculation. Clinically, it is a benign process, but microscopically it has the characteristics of a mild chronic inflammation. Although there is good reason to infer from a study of the embryology of the tongue that the lesion arises as a developmental anomaly of the epithelium—perhaps from the tuberculum impar—there is no direct proof of this.

Brocq and Pautrier's original descriptive title of the lesion is rather ponderous. It is probably better called (after Lane, 11) "glossitis rhombica mediana" or the English counterpart "median rhomboid glossitis." This title has the advantage of being descriptive without being unwieldy. Cutler (35) calls the lesion "papilloma durum."

The lesion is not a common one, but it is probably less rare than is supposed. Its lack of symptoms and its location quite far back on the tongue undoubtedly account for its being overlooked frequently. It is important to recognize this lesion as a process distinct from syphilis, tuberculosis, and malignancy with which it has been occasionally confused.

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THE VALUE OF ASSESSING AND PRESCRIBING DOSAGE IN RADIATION THERAPY IN SIMPLE TERMS[1]

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THE evolution of radiotherapy has been so rapid that progress is now being hindered by methods of prescribing and of reporting dosage which are obsolete, and should be discarded. In the earlier stages, really accurate knowledge of that one essential, the amount of radiation absorbed, was lacking, and for years it was necessary to define technic by describing in detail all the variable factors. During the transition period such details could not be omitted, but I feel that they now confuse rather than assist clear thinking. If comparison of method is to be worth while, and further progress is to be made, all the variables must be summated into a statement which gives only the essential primary factors. These I believe to be:

(1) *Dose*, or quantity of radiation absorbed;
(2) *Quality*, or wave length of radiation, and
(3) *Time*, or duration of treatment.

Adequately expressed, these three factors give all the necessary information. The second factor, quality, must always be described separately, and there are recognized methods of measuring wave length which I do not intend to discuss here. The first and third factors are so closely connected that they cannot be separated. Therefore, although this article deals with the first and more important—dosage—certain comments concerning the time factor are necessarily included.

A paper such as this is an expression of personal opinion, and as such may appear to be dogmatic. I am well aware that controversial issues are being ignored, but it is worth an effort to go straight through the difficulties to what I believe to be the fundamental facts regarding the dose absorbed. I am, therefore, sub-dividing and dealing in the first section with:

(1) General principles relating to all forms of radiation;
(2) X-ray dosage, and
(3) Radium dosage.

In the second section, at the risk of appearing over-critical, I am enumerating under the following headings certain methods of recording dosage which I believe should be discarded:

(4) Roentgens in air;
(5) Erythema dose;
(6) Summated roentgens to skin fields;
(7) Ergs and I-Mc;
(8) Radium erythema dose;
(9) Millicurie-hours, and millicuries destroyed.

Finally, as Section 10, I will try to illustrate the value of what I believe to be the most satisfactory method of prescribing and recording dosage of radiation.

(1) *General Principles.*—The essential features of any valid method of dosage computation include as a first necessity the possibility of expressing the dose in terms of amount of radiation without reference to the changes produced. When a drug is under consideration, a dose is a quantity, not an effect; thereafter, the various effects are studied in relation to variation of dosage. Inevitably, because it has already gained international acceptance, that quantity in radiation therapy has to be given in roentgens. The roentgen itself is a simple physical concept of an amount of radiation, about which there is little argument. Problems begin to arise only when we come to develop methods of measuring roentgens for our purposes. Clinical dosage must be stated in terms of the tissue dose; in the treatment of ordinary malignant dis-

[1] Read before the Society of Radiotherapists of Great Britain and Ireland, March 18, 1938.

ease the only tissues which have to be considered are tumor and skin. Two things, and two things only, have real importance; the dose at the tumor and the dose at the skin which has to be irradiated during treatment. The dosage system must determine the dose actually received at every point in a tumor, usually by stating maximum and minimum doses. Computation of dose to the skin should be thought of in terms of the dose delivered at that point, in the area irradiated, which receives the highest dose.

In actual clinical work, however, a statement of mere quantity is itself inadequate. The duration of exposure has a profound influence on the effects produced. Thus any consideration of the correct dose to be given to produce a particular effect requires that a statement be made of the time over which that dose is spread, *i.e.*, overall time. Reinhart, Quimby, and previously, Kingery have tried, and are trying, to devise methods of combining these two, dose and time, under one concept—the "cumulative" dose. At the moment, however, the experimental foundations of these theories are inadequate, and I, at least, feel that we should for the present state "dosage in relation to time"—for example, 6,000 r in eight days, 2,250 r in one hour, 10,000 r in ten weeks, and so on.

The possibility of stating skin and tumor dose categorically in the manner suggested is often questioned, but the difficulty can be overcome. The physicists have not yet solved all the problems involved in applying this rather curious r unit to our purposes. The chief problem which arises is that roentgens are not automatically a direct index of energy absorbed. It would seem that radiation effect is directly related to energy absorbed, and thus effect may not necessarily run parallel to dosage in roentgens under all conditions of absorption and wave length. This is particularly true in relation to the absorption in skin and bone. In spite of the unsolved physical problems, the physicists have obtained information accurate enough to allow progress, and the uncertainty in this respect should not detract from the real value of that which has already been clearly demonstrated.

The methods of assessing quantity of x-radiation and quantity of gamma-radiation are different, and require separate consideration.

(2) *X-ray Dosage.*—In x-radiation the first process in any calculation is to assess the true surface dosage at each field. This can be arrived at in two distinct ways, both of which are useful. The first is to measure once and for all for certain plant output rates in air, the dose delivered at the body surface, using applicators of various sizes, or by the radiation of fields of various areas. This is usually done by previous measurement in wax or water phantoms, using the applicators likely to be employed in the department. An attempt is then made by means of bolus bags, rice bags, and other methods of building up the volume, to duplicate the phantom conditions during actual treatment.

The alternative method is to measure this surface dose directly at the skin itself by means of an integrating dosimeter placed on the skin.

Both of these are perfectly valid methods, but both have difficulties, and require that certain precautions be very strictly observed. In the water or wax phantom method, it is essential to be very thorough with back-scattering media, or to make allowance for differences from the original conditions of measurement, as is done for instance, by Quimby's correction curves for radiation in lung, etc. Moreover, there must be some way in which the plant output rate can be reasonably maintained, as this is not being measured during treatment. Using the integrating dosimeter method, the readings made are only strictly valid if the dosimeter is dead in the center of the beam, and half countersunk into skin. Such conditions are by no means adequately observed, or, in many cases, even attempted. As a result, the latter method, though theoretically perfect, may be very risky. Of the two the first is, I think, to be preferred, unless there are

special departmental reasons to the contrary.

Both of these methods will measure the actual dose in roentgens which has been received by the skin. It is redundant, therefore, to talk of this measurement as "dose with back-scatter," since scattered radiation has to be included in order to measure the unknown—the dose at a surface. It is not possible to measure a dose absorbed at a body surface without back-scatter.

Tumor dose is arrived at in terms of percentage depth dose: That is to say, by the use of charts showing the fraction of the surface dose which will be absorbed at that depth at which the tumor is, by various devices, assessed to lie. For the kilovoltages in use to-day, such percentage depth dose charts already exist in a variety of forms. For the new supervoltage installations, before quantity of radiation reaching a tumor can be assessed, new depth dose charts will have to be constructed. In single-field treatments the tumor dose is usually stated in terms of dose at the center of the tumor; in crossed-field technics, dose is the sum of all contributions received from various fields. If correctly arrived at, this sum states directly in roentgens the amount of radiation received by the tumor. Actually, insofar as the assessment is made at the point where the centers of the various beams cross, the maximum dose in the tumor zone, rather than the minimum, is usually being stated.

Skin dose, in the case of a single field treatment, is the surface dose as already described. In the case of multiple fields, however, each area of skin may also receive contributions through the body from other fields. The amount of such contributions must be calculated by the use of depth dose graphs as in the assessment of tumor dose. The true skin dose is the sum of the incident surface dose plus such contributions. I think it will be agreed that this is the only measure of the total amount of radiation received at any point in that particular area of skin concerned.

To bring this question of x-ray dosage into focus, the bare essentials of an x-ray prescription may be shown by one example (Fig. 1).

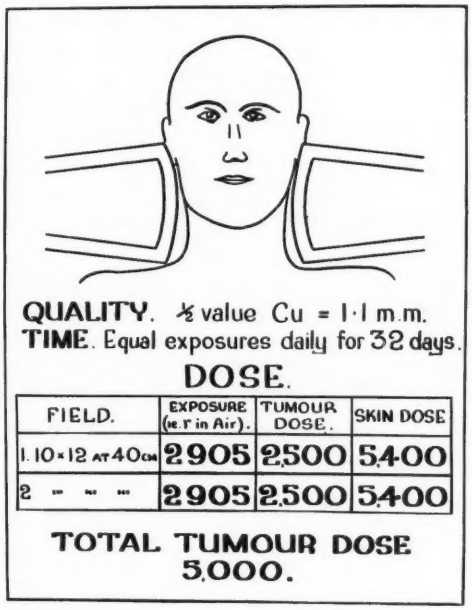

Fig. 1.

(3) *Radium Dosage.*—Radium dosage assessment is in one sense simpler, in another more complex, than x-ray. It is simpler in that the source of radiation is very constant, and because of this constancy we can devise methods for assessing the dosage at any point at a known distance from any arrangement in space of radio-active foci. It is then accepted that when the point lies in tissue, the same dose will be absorbed. This occurs in ordinary radium work because with the volumes implanted and the areas of skin usually irradiated, the effects of scatter in the case of gamma rays approximately neutralize the loss from absorption. Thus the dose assessed in air and the dose absorbed in tissue are identical. The radium collar and the bomb are slight exceptions to this generalization.

The radium problem is complex in that the dose has, by some means or other, to be assessed at a variety of points, and often from a large number of radio-active foci.

Further, if the international roentgen is to be adopted as the unit of radiation, it has to be assessed in roentgens. I think by a combination of mathematical and physical means, sufficiently useful methods of assessing dosage can be devised, even in very complex arrangements of radio-active foci. This was first achieved satisfactorily in terms of ergs per cubic centimeter by Murdoch and Stahel. In articles published by Parker and the writer[2] simpler dosage systems for both superficial radium therapy and for interstitial work are outlined. These methods are intended to provide a satisfactory method of prescribing in terms of amount of gamma-radiation absorbed, and to avoid the cumbersome statement of detail by considering milligram hours as a dosage system.

The evaluation of the gamma-ray intensity at one centimeter from one milligram of radium has proved a physical problem difficult to solve, but the various investigators whose work can be accepted are now very close indeed to agreement, and the roentgen can be legitimately used for gamma-ray measurement. Parker, in 1932, evaluating from Gray's experiments, used 8.4 as the basis of our dosage graphs and I see no indications for departing from that value.

This is a very abbreviated presentation of one approach to the dosage problem, and it may clarify the position to contrast with this certain other commonly used methods purporting to indicate dosage, to try to find out what they really indicate, and to assess what information they yield.

(4) *Roentgens in Air.*—The first and most important practice which I should like to see abolished is r in air. This is a measure of the intensity of an x-ray beam at a certain distance from the target, but it is not in any sense a measure of a dose absorbed. When the statement is made that an area of skin has had a dose of 300 r in air, the information really conveyed is that this area has been exposed to a beam of known intensity for a period of time. If the statement is further qualified by noting the size of the field, the wave length, and the portion of the body irradiated, an estimate of the actual dose received by that skin is possible to those with experience, but the statement of the conditions cannot be omitted. R in air for x-ray is rather like milligram-hours in radium—it has a limited value in describing a technic which it is desired to duplicate, but no value in stating or prescribing dosage.

Criticism of the definite acceptance of tissue dose, whether on the surface or deep, as an entity is almost always founded on the plea that by international definition, the roentgen has to be measured in air. Since the International Units Committee approved the new definition of the roentgen, the whole idea is modified. All that the international definition requires is that the radiation being absorbed at any point be estimated by the amount of ionization produced in a tiny air-filled cavity at that point. In Figure 2 situation *A* is that in which measurement of radiation is made in air, in that the air-filled cavity is surrounded by air. The measurement is, therefore, one of the intensity of the beam. In *B* the air-filled cavity is on a surface (tissue or water) and, therefore, the ionization measured in the air of the cavity is a measure of the radiation being absorbed at that surface. In *C* we have a situation giving a true measure of the dose in tissue. The radiation is being assessed by ionization in air, *i.e.*, in the air-filled cavity, as required by the definition, but in terms of real tissue dose.

Summarizing, therefore, r in air is a measure of the intensity of a beam of radiation, and therefore a method of measuring and stating tube output, but it does not measure dose.

(5) *Erythema Dose.*—In the early days of radiation therapy, the erythema dose as a measure of a quantity of radiation served a real purpose. At the time of its development, ionization chambers were weird and wonderful, but scarcely accurate. Chemical and photographic methods were very crude, and the most accurate way of

[2] British Jour. Radiol., **7**, October, 1934, and British Jour. Radiol., **11**, May, 1938.

assessing an amount of radiation was to find the exposure necessary to produce a certain defined type of erythema under

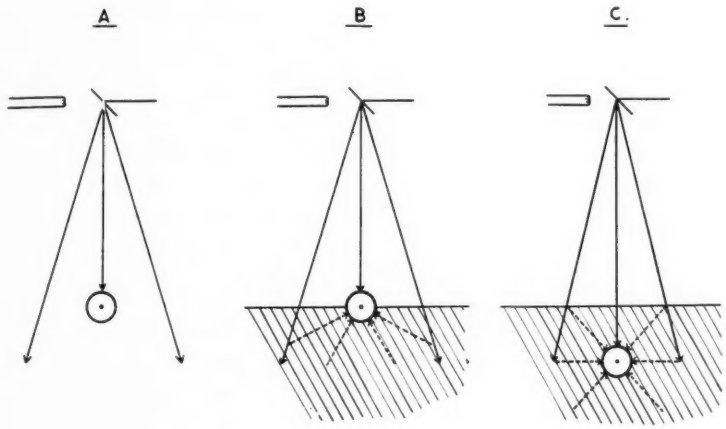

Fig. 2.

given, conditions, and then to give fractions or multiples of this amount under the same or similar conditions. It is essential to note that even at this stage this was merely a crude method of measuring an amount of radiation, a method identical in principle with other biologic assays, for example, the older methods of assaying diphtheria antitoxins or vitamin values. The patient was being used temporarily as an experimental animal.

The erythema dose had a right to survive only so long as there were no better instruments for measuring quantity of radiation. This lack has been filled by the modern ionization chamber. In actual practice to-day, the so-called erythema dose is found to mean little more than a fixed period of exposure at certain fixed plant factors, and I wonder how many centers would have to go back several months or even years to their last assessment of the E.S.D. or H.E.D., by the production of a standard erythema according to definition.

(6) *Summated r to Skin Fields.*—The third practice which I should like to see abolished is the habit of stating the skin dose as the sum of all the skin doses to various fields. For example, in a four-field technic in which each field gets 5,000 r, the skin is described as having had 20,000 r.

I feel that a statement to the effect that a dose of 20,000 r to skin had been given ought to provoke the immediate question: how was the resultant necrosis dealt with? The anomaly may perhaps be best illustrated in this way: if the abdomen is exposed to four contiguous fields, each 5×5, and given 3,000 r through each, the dose using this summated r to skin method of prescription will be described as 12,000 r; but if the same area is exposed to a single field of 20×20, then as far as the skin is concerned, exactly the same dose has been given, and yet now the given dose can only be called 3,000 r. Probably the general idea underlying the custom is, that if all these fields are aiming at the same point, for instance at the cervix, with a 30 per cent depth dose, then that cervix will have received 30 per cent of 12,000 r. But how much easier to go straight to the information wanted, and define the dose to the cervix as 3,600 r.

(7) *Ergs and Intensity Millicurie.*—Radium dosage raises other ideas, the most

important being the ergs/c.c. of Murdoch, and Sieverts' intensity-millicurie. These are real dosage units, and there is nothing to be said against them in principle. It just so happens that, rightly or wrongly, the roentgen has been chosen as the gamma-ray unit for therapy, and for convenience a majority decision must be accepted. Real measurement in ergs would have had, in fact, certain advantages. Before perfect assessment of radiation effects becomes possible, particularly in regard to the contrast of wave lengths on different tissues, dose will have to be measured in actual energy absorbed, for which the erg is the unit. A practical method of doing this, however, has not yet been found by the physicists.

(8) *Radium Erythema Dose.*– The threshold erythema dose like the x-ray erythema dose, has served its purpose, and it is reasonable to expect it now to be expressed in the accepted unit, the roentgen. To say so at this stage is in no way to decry the real contribution to radiotherapy made at the Memorial Hospital through their threshold erythema dose. I think the first really adequate attempts to determine tumor lethal dose quantitatively were made there, using that unit. If I read their publications correctly, that unit is now so linked to statistical and physical factors as to admit re-assessment of the threshold erythema dose at some figure a little under 1,000 r, the actual figure varying slightly with the medium employed, gold seeds, needles, or plaques, but I think within narrow limits.

(9) *Milligram-hours, and Millicuries Destroyed.*—It seems incredible that this unit should still be looked upon as a dosage unit, as milligrams bear exactly the same relationship to radium dosage as milliamperes, taken alone without any description of voltage, distance, etc., bear to x-ray dosage. The inadequacy of the present all too common custom of stating radium dosage in milligram-hours or in millicuries destroyed is best illustrated by considering how little information would be yielded by describing an x-ray treatment as having given a dose of x milliampere-minutes. Milligram-hours is only one of the many factors in a treatment, and to convey information all the other factors must be known—filtration, spacing, distance, etc. Even where all the factors are stated perfectly, it is practically impossible to gather any real idea of the dose given. Hence, as in x-ray dosimetry, it has become essential to devise methods such that all the variables are summated into one single statement of the dose in roentgens at the point under consideration.

CONCLUSIONS

In conclusion, may I try to illustrate much of what I have been attempting to say by giving examples of the kind of information we hope to be able to gain by a more simplified statement of our treatment figures. Here are three statements:

(1) 4,750 r in eight days is a lethal dose to 80 per cent of squamous-cell carcinomas;

(2) 8,000 r in ten weeks is a sub-lethal dose to the majority of squamous-cell carcinomas;

(3) Skin tolerance, for a small area, ranges from just under 3,000 r in one hour, to well over 10,000 r in ten weeks.

Please do not direct attention to the truth or otherwise of the actual statements made. I think all three statements are true, or at least not far off the truth, that is why they were chosen. The point I am anxious to make is not the truth of, but the need for, and possibility of, such statement. All three are abstract generalizations and quite detached from any questions of technic, such as site, wave length, etc. They are in a sense, almost academic. I feel that one of the great needs of present-day therapy is to build up our conceptions of dosage measurement in such a way that information can be gradually accumulated to develop such general information, and I

should like, therefore, to use these three statements as a guide to the evaluation of the best way of connoting and describing dosage. If a dosage system can be used to develop such generalizations, it passes; if it fails to do so, it must be discarded as of little value.

The value of thinking and prescribing in the literal sense of the word *i. e., pre*-scribing the real dosage to tumor and skin is unquestionable. Once the habit is acquired the difficulties of the old method are forgotten. Put shortly, tumor dose is thought of first, skin dose next, and last of all the technic by which the dose will be delivered.

POINTS OF INTEREST

It is the purpose of the Inter-Society Committee for Radiology to promote the benefits to be derived from organized activity. Among other things the Committee encourages the formation of local, regional, and state societies of radiologists. Not only should these carry on the usual scientific programs, but they should take active and constant interest in the economic and social problems of radiology in their locality. Unethical practices by hospitals and their own members are questions deserving the attention of these local groups. The prevention of illegal practice by laymen, below-standard practice in eleemosynary institutions, exploitation and competition by hospitals and other corporations, the ethical promotion of early diagnosis and preventive medicine—all these are proper subjects for local action. Wherever possible, organized effort on the part of radiological groups should be carried on under the aegis and through the machinery of the county and state medical societies.

Among the news items in this month's Bulletin, the Inter-Society Committee calls attention to a few of the interesting developments and desirable projects by local and state radiological societies in various sections of the country.

* * *

Alert members of the *Pacific Roentgen Club* continue a winning battle to protect radiology against domination by corporate agencies and third parties in new economic experiments for medical care. The Medical Service Plan, adopted by the California Medical Association on Dec. 18, 1938, provides for pre-payment under an insurance plan to be supervised by the medical profession. Complete medical and hospital care is provided. Radiological bills are paid along with other medical bills and hospital care is defined as consisting of those non-medical services which a hospital is legally qualified to give, *viz.*, bed, nursing, drugs, physiotherapy, and material appliances.

Efforts are being made to correct the recently inaugurated San Francisco Municipal Employees Health Service System which now includes an allowance for diagnostic medical procedures in its *per diem* payment to hospitals for hospitalized illnesses. Vigilance has not been relaxed in regard to the several hospital care insurance plans which, due to the efforts of the Club's officers, have agreed to confine their benefits to hospital services alone.

New rates for malpractice insurance imposed by the Insurance Commissioner of California will more than double the premium now paid by California members of the Radiological Society of North America and the American Roentgen Ray Society under their blanket agreement with Lloyds of London. These members are still endeavoring to secure an agreement that will permit them to retain their preferred rating.

The twenty-fourth issue of the *Bulletin of the Pacific Roentgen Club*, now a semi-annual publication, was issued last month.

* * *

Reports reaching the Inter-Society Committee are that the *Medical Society of West Virginia* has approved the adoption of hospital insurance plans, with the provision that benefits are to be defined by local county medical societies. It is presumed that county societies will follow the principle enunciated by the American Medical Association, requiring that no medical services be included as part of hospital care.

* * *

The secretary of the *Michigan State Medical Society* recently spent several days in the Inter-Society Committee offices for the purpose of discussing a proposed hospital insurance plan to be directed by the state society. Hospitals in Detroit have created a plan of their own. Radiology is not included as a hospital benefit.

* * *

Nearly every state medical association in the country is investigating the desirability of perfecting a non-profit insurance plan for the pre-payment of medical bills for low income patients. *North Carolina* is not excluded. Radiologists there report that the proposed plan will reimburse policy holders for services received from radiological specialists in the

same manner that other medical and surgical benefits are provided.

An interesting fiscal arrangement for hospital practice has been accepted by radiologists working in one Asheville hospital. In the case of charity patients, the physicians contribute their services and the hospital contributes supplies and the use of its equipment. Pay patients receive a bill for all radiological charges on the physician's bill-head. Collections are held in trust by the hospital cashier. All receipts are turned over to the radiologists, who reimburse the hospital for expenses incurred in maintaining the department on an arbitrary basis of two dollars for each film used on a private patient.

* * *

The Council of the *Illinois Medical Society* has adopted a resolution that was distributed by the Inter-Society Committee last year to its list of state representatives. The resolution clarifies certain principles pertaining to the relationships between physicians and hospitals. Among other things it demands that, "No hospital shall offer, for a price, any medical service." The same resolution has been adopted by the Wyandotte County Medical Society (Kansas), the Hillsborough County Medical Society (Florida). It has been approved in modified form by several other county and state societies. Interested members may receive copies of the complete resolution by writing to the Inter-Society Committee office.

* * *

The *Nebraska Radiological Society* prepared a resolution, which was introduced at the last annual meeting of the state society, calling upon the society to affirm the action of the A.M.A. in regard to relations between hospitals and radiologists. It resolved that all services connected with the practice of radiology should be under the direct control and supervision of the medical profession. At the request of the Radiological Society, the Omaha-Douglas County Society has forbidden the inclusion of radiology as part of hospital care in a proposed hospital insurance plan.

* * *

In addition to its annual scientific conference in the Summer, the *Denver Radiological Club* maintains an active interest in the economic problems of radiology. Members were successful last year in defeating attempts by local hospitals to include radiological services as a part of their care in a hospital insurance plan. The Colorado State Medical Society was brilliantly successful in defeating a bold attempt by chiropractors to amend the State Constitution in such a manner as to permit them to engage in medical diagnosis and treatment. The amendment was overwhelmingly defeated in the last state election.

* * *

Radiological practice will benefit from two decisions recently made by organized medicine in *Oregon*. A special committee has been appointed by the state society to make an investigation and recommendations relative to the status of radiologists and pathologists in hospitals in connection with a medical insurance plan to be operated by the medical profession. The Multnomah County Medical Society (Portland) has requested that a charge of three dollars be made to insurance companies for all reports pertaining to applicants or claimants. This action will eliminate attempts by insurance carriers to secure certified statements by radiologists without paying a fee.

* * *

The following resolution and motion were unanimously adopted at the San Antonio meeting of the *Texas Radiological Society* on Oct. 22, 1938:

WHEREAS, the science and art of radiology is a recognized specialty in the practice of medicine, and

WHEREAS, the hospitals supported by the State of Texas, the Veterans Bureau, and the Public Health Service are justly models for other hospitals, both private and charitable, and

WHEREAS, one of the requirements for Class A hospital rating recommends that the department of radiology be headed by a radiologist,

BE IT RESOLVED that the Texas Radiological Society, meeting in regular session, recommends that each of the hospitals supported by the State of Texas, the Veterans Bureau, and the United States Public Health Service have a properly qualified radiologist, preferably a diplomate of the American Board of Radiology, head their individual radiological departments.

The resolution was indorsed by the Texas State Board of Health at its annual meeting in December. The Texas State Medical Association will be asked to adopt it at the next annual session.

A schedule of fees for industrial work adopted by the *Iowa X-ray Club* a number of years ago has been enthusiastically supported by industrial insurance companies. It has eliminated the evil of occasional fees below the actual cost of complete and careful examination. Both radiologists and insurance companies are well pleased with the results of the project.

Iowa radiologists have likewise adopted a method for charging fees to the U. S. Employees Compensation Commission which assures a fair and adequate fee for examination of traumatic injuries suffered by workers employed by the Federal Government. The fee schedule issued by the ECC was proposed by the American Hospital Association and defrays the cost of technical work only. The inequities of the schedule have caused consternation and complaint by radiologists throughout the country. In Iowa, radiologists add a fair and reasonable fee for consultation to the ECC fee for technical work, bringing the total to equal the charge allowed by the industrial fee schedule mentioned above. These fees are paid by the ECC without objection.

* * *

Dismissal of the radiological staff of the Tampa Municipal Hospital and discharge of the hospital superintendent, followed by appointment of one man to serve in the dual capacity of superintendent-radiologist, touched off a controversy in *Florida* which culminated in a wholesale war involving the county medical society, the hospital trustees, and the mayor, and attracted the attention of the American Hospital Association, the American College of Surgeons, and the A.M.A. After months of debate, a new superintendent was appointed on Dec. 13, 1938. The salaried radiologist remains, however, supplanting the former staff which reimbursed the hospital on a percentage basis for its expenses in maintaining the department.

Following initial objections by the hospital staff and the county medical society, the hospital trustees received a letter from Bert W. Caldwell, Secretary of the A.H.A., congratulating the board upon its action and applauding the employment of a salaried radiologist as "good business as well as good administrative policy." Thereupon the American College of Surgeons removed the hospital from its approved list on the grounds that the dual responsibilities of superintendent and radiologist could not be successfully combined in the hospital. Before the board of trustees had complied with the demands of the College of Surgeons, they received another request from the A.M.A. Council on Medical Education and Hospitals to take additional steps to comply with the principles of the Council. Beside replacing the superintendent, the board discharged from the staff fourteen doctors who were not members of the county medical society.

* * *

The following resolution, introduced by Dr. Stanley A. Clark, President of the *Indiana Roentgen Ray Society*, and Dr. A. S. Giordano, President of the Indiana Association of Pathologists, was adopted by the Indiana State Medical Association at its annual meeting on Oct. 4, 1938:

WHEREAS, The American Medical Association has through its House of Delegates and its various bureaus and councils from time to time propounded certain principles of ethics and established standards of relationships looking toward the maintenance of the highest quality of professional service both in private practice and in hospitals; and

WHEREAS, Many of these pronouncements refer specifically to those special branches of medicine involving somewhat unusual relationship between hospital institutions and the physician practising these specialties in the hospital; and

WHEREAS, Certain usages have sprung up which are tending to involve ethical and legal consideration; and

WHEREAS, It would appear to be highly desirable and in the best interests of good medical practice and sound public policy to have certain of the aforementioned pronouncements clarified, codified, and in some instances reiterated; and

WHEREAS, At the last meeting of the American Medical Association at San Francisco, in June, 1938, a resolution requesting the Council on Medical Education and Hospitals to study the status of clinical and pathologic laboratories, and radiologic departments in hospitals and institutions, with a view toward standardizing the relationship of these services to these institutions and, when necessary, reaffirming principles of ethics involved in these relationships; and

WHEREAS, The practice of medicine combines the exercise of professional knowledge and judgment and technical skill; and

WHEREAS, Hospitals and other lay organizations associated with physicians in the care of the sick find it essential to have available competent departments of roentgenology and clinical pathology; and

WHEREAS, Physicians especially trained in the selection, use, and interpretation of diagnostic aids in clinical pathology and roentgenology are a recognized necessity in medical practice; and

WHEREAS, The technical skill required in the practice of roentgenology and clinical pathology needs to

be supplemented by the professional knowledge and judgment of a physician before it is used in the diagnosis and treatment of disease; therefore:

BE IT RESOLVED, That the Indiana State Medical Association reaffirm the action of the House of Delegates of the American Medical Association, "that the practice of clinical pathology and roentgenology is the practice of medicine," and recommends that clinical and roentgenological laboratory services be excluded from service contracts which exclude other professional services; and

WHEREAS, Our duty to the sick and afflicted is to furnish the best service possible; therefore

BE IT FURTHER RESOLVED, That all laboratories practising these specialties should be recognized as being ethical only when they are operated and supervised by a physician trained and recognized as being competent in these specialties in medicine, and

BE IT FURTHER RESOLVED, That laboratories, which indulge in unfair competition by wholesale advertising of cut-rate prices, be specifically classed as unethical and unworthy of support by ethical members of the profession.

MAC F. CAHAL
Executive Secretary

540 N. Michigan Ave.
Chicago

RADIOLOGICAL SOCIETIES IN THE UNITED STATES

Editor's Note.—Will secretaries of societies please cooperate with the Editor by supplying him with information for this section? Please send such information to Leon J. Menville, M.D., 1201 Maison Blanche Bldg., New Orleans, La.

CALIFORNIA

California Medical Association, Section on Radiology.—Chairman, Karl M. Bonoff, M.D., 1930 Wilshire Blvd., Los Angeles; *Secretary,* Carl D. Benninghoven, M.D., 95 S. El Camino Real, San Mateo.

Los Angeles County Medical Association, Radiological Section.—President, John F. Chapman, M.D., 65 N. Madison Ave., Pasadena; *Vice-president,* E. N. Liljedahl, M.D., 1241 Shatto St.; *Secretary,* Merl L. Pindell, M.D., 678 South Ferris Ave.; *Treasurer,* Henry Snure, M.D., 1414 Hope Street. Meets every second Wednesday of month at County Society Building.

Pacific Roentgen Club.—Chairman, Lyell C. Kinney, M.D., San Diego; *Secretary,* L. Henry Garland, M.D., 450 Sutter Street, San Francisco. Executive Committee meets quarterly; Club meets annually during annual session of the California Medical Association.

San Francisco Radiological Society.—Secretary, L. H. Garland, M.D., 450 Sutter Street. Meets monthly on first Monday at 7:45 P.M., alternately at Toland Hall and Lane Hall.

COLORADO

Denver Radiological Club.—President, F. B. Stephenson, 452 Metropolitan Bldg.; *Vice-president,* K. D. A. Allen, M.D., 452 Metropolitan Bldg.; *Secretary,* E. A. Schmidt, M.D., 4200 E. Ninth Ave.; *Treasurer,* H. P. Brandenburg, M.D., 155 Metropolitan Bldg. Meets third Tuesday of each month at homes of members.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—Chairman, Ralph T. Ogden, M.D., 179 Allyn St., Hartford; *Secretary-Treasurer,* Max Climan, M.D., 242 Trumbull St., Hartford. Meetings twice annually in May and September.

DELAWARE

Affiliated with Philadelphia Roentgen Ray Society.

FLORIDA

Florida Radiological Society.—President, H. O. Brown, M.D., 404 First National Bank Bldg., Tampa; *Vice-president,* H. B. McEuen, M.D., 126 W. Adams St., Jacksonville; *Secretary-Treasurer,* J. H. Lucinian, M.D., 168 S. E. 1st St., Miami.

GEORGIA

Georgia Radiological Society.—President, James J. Clark, M.D., Doctors Bldg., Atlanta; *Vice-president,* William F. Lake, M.D., Medical Arts Bldg., Atlanta; *Secretary-Treasurer,* Robert C. Pendergrass, M.D., Prather Clinic, Americus. Meetings twice annually, in November and at the annual meeting of the Medical Association of Georgia in the spring.

ILLINOIS

Chicago Roentgen Society.—President, David S. Beilin, M.D., 411 Garfield Ave.; *Vice-president,* Chester J. Challenger, M.D., 3117 Logan Blvd.; *Secretary-Treasurer,* Roe J. Maier, M.D., 7752 Halsted St. Meets second Thursday of each month, September to May, except December.

Illinois Radiological Society.—President, Cesare Gianturco, M.D., 602 W. University Ave., Urbana; *Vice-president,* Fred H. Decker, M.D., 802 Peoria Life Bldg., Peoria; *Secretary-Treasurer,* Edmund P. Halley, M.D., 968 Citizens Bldg., Decatur. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—The next meeting will be May 2, 3, 4, 1939, to be held in Rockford. The officers of the Section for the coming meeting are Harry B. Magee, M.D., of Peoria, *Chairman,* and Warren W. Furey, M.D., 6844 Ogleby Ave., Chicago, *Secretary.*

INDIANA

Indiana Roentgen Society.—President, Stanley Clark, M.D., 108 N. Main St., South Bend; *President-elect,* Juan Rodriguez, M.D., 2903 Fairfield Ave., Fort Wayne; *Vice-president,* A. C. Holley, M.D., Attica; *Secretary-Treasurer,* Clifford C. Taylor, M.D., 23 E. Ohio St., Indianapolis. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

MAINE

See New England Roentgen Ray Society.

MARYLAND

Baltimore City Medical Society, Radiological Section.—Chairman, Whitmer B. Firor, M.D., 1100 N. Charles St.; *Secretary,* Walter L. Kilby, M.D., 101 W. Read St. Meetings third Tuesday of each month.

MASSACHUSETTS

See New England Roentgen Ray Society.

MICHIGAN

Detroit X-ray and Radium Society.—President, Sam W. Donaldson, M.D., 326 N. Ingalls St., Ann Arbor;

Vice-president, Clarence Hufford, M.D., 421 Michigan Ave., Toledo, Ohio; *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave.

Michigan Association of Roentgenologists.—President, E. R. Witwer, M.D., Harper Hospital, Detroit; *Vice-president*, D. W. Patterson, M.D., 622 Huron Street, Port Huron; *Secretary-Treasurer*, C. K. Hasley, M.D., 1429 David Whitney Bldg., Detroit. Meetings quarterly by announcement.

MINNESOTA

Minnesota Radiological Society.—President, Walter H. Ude, M.D., 78 S. 9th St., Minneapolis; *Vice-president*, Leo G. Rigler, M.D., University Hospitals, Minneapolis; *Secretary-Treasurer*, Harry Weber, M.D., 102 Second Ave., S. W., Rochester. Meetings quarterly.

MISSOURI

The Kansas City Radiological Society.—President, L. G. Allen, M.D., 907 N. 7th St. Kansas City, Mo.; *Secretary*, Ira H. Lockwood, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—President, Paul C. Schnoebelen, M.D.; *Secretary*, W. K. Mueller, M.D., University Club Bldg. Meets on fourth Wednesday of October, January, March, and May, at a place designated by the president.

NEBRASKA

Nebraska Radiological Society.—President, T. T. Harris, M.D., Clarkson Memorial Hospital, Omaha; *Secretary*, D. Arnold Dowell, M.D., 117 S. 17th St., Omaha. Meetings first Wednesday of each month at 6 P.M. in Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY

(Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.) *President*, Frank E. Wheatley, M.D., 520 Beacon St., Boston; *Secretary*, E. C. Vogt, M.D., 300 Longwood Ave., Boston. Meetings third Friday of each month from October to May, inclusive, usually at Boston Medical Library.

NEW HAMPSHIRE

See New England Roentgen Ray Society.

NEW JERSEY

Radiological Society of New Jersey.—President, Milton Friedman, M.D., 31 Lincoln Park, Newark; *Vice-president*, P. S. Avery, M.D., 546 Central Ave., Bound Brook; *Secretary*, W. James Marquis, M.D., 198 Clinton Ave., Newark; *Treasurer*, James Boyes, M.D., 744 Watchung Ave., Plainfield. Meetings at Atlantic City at time of State Medical Society, and Midwinter in Newark as called by president.

NEW YORK

Brooklyn Roentgen Ray Society.—President, Albert Voltz, M.D., 115–120 Myrtle Avenue, Richmond Hill; *Vice-president*, A. L. L. Bell, M.D., Long Island College Hospital, Henry, Pacific, and Amity Sts., Brooklyn; *Secretary-Treasurer*, E. Mendelson, M.D., 132 Parkside Ave., Brooklyn. Meetings first Tuesday in each month at place designated by president.

Buffalo Radiological Society.—President, Walter Mattick, M.D., 101 High St.; *Vice-president*, Chester Moses, M.D., 333 Linwood Ave.; *Secretary-Treasurer*, J. S. Gian-Franceschi, M.D., 610 Niagara Street. Meetings second Monday evening each month, October to May, inclusive.

Central New York Roentgen-ray Society.—President, W. E. Achilles, M.D., 60 Seneca St., Geneva; *Vice-president*, M. T. Powers, M.D., 250 Genesee St., Utica; *Secretary-Treasurer*, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse. Meetings held in January, May, and October as called by Executive Committee.

Long Island Radiological Society.—President, Samuel G. Schenck, M.D., Brooklyn; *Vice-president*, G. Henry Koiransky, M.D., Long Island City; *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn; *Treasurer*, Louis Goldfarb, M.D., 608 Ocean Ave., Brooklyn. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—President, Raymond W. Lewis, M.D., 321 E. 42nd St., New York City; *Vice-president*, Henry K. Taylor, M.D., 667 Madison Ave., New York City; *Secretary*, Roy D. Duckworth, M.D., 170 Maple Ave., White Plains; *Treasurer*, Eric J. Ryan, M.D., St. Luke's Hospital, New York City; *Member of Executive Committee*, E. Forrest Merrill, M.D., 30 W. 59th St., New York City. Meetings third Monday evening each month at Academy of Medicine.

Rochester Roentgen-ray Society.—Chairman, Joseph H. Green, M.D., 277 Alexander St.; *Secretary*, S. C. Davidson, M.D., 277 Alexander St. Meetings at convenience of committee.

Associated Radiologists of New York, Inc.—President, Albert L. Voltz, M.D., 115–120 Myrtle Ave., Richmond Hill; *Vice-president*, M. M. Pomeranz, M.D., 911 Park Ave., New York City; *Secretary*, W. J. Francis, M.D., 121 Madison Ave., New York City; *Treasurer*, Theodore West, M.D., United Hospital, Port Chester. Meetings first Monday evening each month at McAlpin Hotel.

NORTH CAROLINA

Radiological Society of North Carolina.—President, Robert P. Noble, M.D., 127 W. Hargett St. Raleigh; *Vice-president*, A. L. Daughtridge, M.D., 144 Coast Line St., Rocky Mount; *Secretary-Treasurer*, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meetings with State meeting in May, and meeting in October.

OHIO

Cleveland Radiological Society.—President, John Heberding, M.D., St. Elizabeth's Hospital, Youngstown; *Vice-president,* R. V. May, M.D., St. Luke's Hospital, Cleveland; *Secretary-Treasurer,* Harry Hauser, M.D., City Hospital, Cleveland. Meetings at 6:30 P.M. at the Mid-day Club, in the Union Commerce Bldg., on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*President,* B. M. Warne, M.D., Doctors Building, Cincinnati; *Secretary-Treasurer,* Justin E. McCarthy, M.D., 707 Race St., Cincinnati, Ohio. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—President, Charles S. Caldwell, M.D., 520 S. Aiken Ave., Pittsburgh; *First Vice-president,* Thomas L. Smyth, M.D., 111 N. 8th St., Allentown; *Second Vice-president,* Reuben G. Alley, M.D., Western Pennsylvania Hospital, Pittsburgh; *Secretary-Treasurer,* Lloyd E. Wurster, M.D., 416 Pine St., Williamsport; *President-elect,* Louis A. Milkman, M.D., 212 Medical Arts Bldg., Scranton; *Editor,* William E. Reiley, M.D., Clearfield. Annual meeting, May, 1939. Exact date and place to be decided.

Philadelphia Roentgen Ray Society.—President, Thomas P. Laughery, M.D., Germantown Hospital; *Vice-president,* Elwood E. Downs, M.D., Jeans Hospital, Fox Chase; *Secretary,* Barton H. Young, M.D., Temple University Hospital; *Treasurer,* R. Manges Smith, M.D., Jefferson Hospital. Meetings first Thursday of each month from October to May, Thompson Hall, College of Physicians, 19 S. 22nd St., 8:15 P.M.

The Pittsburgh Roentgen Society.—President, William B. Ray, M.D., 320 E. North Avenue, N. S. Pittsburgh; *Secretary,* Harold W. Jacox, M.D., 4800 Friendship Ave. Meetings held second Wednesday of each month at 4:30 P.M., from October to June at various hospitals designated by program committee.

RHODE ISLAND

See New England Roentgen Ray Society.

SOUTH CAROLINA

South Carolina X-ray Society.—President, Percy D. Hay, Jr., M.D., McLeod Infirmary, Florence; *Secretary-Treasurer,* Hillyer Rudisill, Jr., M.D., Roper Hospital, Charleston. Meetings in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

SOUTH DAKOTA

Meets with Minnesota Radiological Society.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee State Radiological Society.—President, S. S. Marchbanks, M.D., 508 Medical Arts Bldg., Chattanooga; *Vice-president,* Steve W. Coley, M.D., Methodist Hospital, Memphis; *Secretary-Treasurer,* Franklin B. Bogart, M.D., 311 Medical Arts Bldg., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Texas Radiological Society.—President, Jerome H. Smith, M.D., San Antonio; *President-elect,* C. F. Crain, M.D., Corpus Christi; *First Vice-president,* M. H. Glover, M.D., Wichita Falls; *Second Vice-president,* G. D. Carlson, M.D., Dallas; *Secretary-Treasurer,* Henry C. Harrell, M.D., 517 Pine St., Texarkana. Meets annually. Temple is place of next meeting.

VERMONT

See New England Roentgen Ray Society.

VIRGINIA

Radiological Society of Virginia.—President, Fred M. Hodges, M.D., 100 W. Franklin St., Richmond; *Vice-president,* L. F. Magruder, M.D., Raleigh and College Aves., Norfolk; *Secretary,* V. W. Archer, M.D., University of Virginia Hospital, Charlottesville.

WASHINGTON

Washington State Radiological Society.—President, H. E. Nichols, M.D., Stimson Bldg., Seattle; *Secretary,* T. T. Dawson, M.D., Fourth and Pike Bldg., Seattle. Meetings fourth Monday of each month at College Club.

WISCONSIN

Milwaukee Roentgen Ray Society.—Secretary, H. W. Hefke, M.D., Milwaukee Hospital, Milwaukee. Meets monthly on first Friday.

Radiological Section of the Wisconsin State Medical Society.—Secretary, Russel F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September.

University of Wisconsin Radiological Conference.—Secretary, E. A. Pohle, M.D., 1300 University Ave., Madison, Wis. Meets every Thursday from 4 to 5 P.M., Room 301, Service Memorial Institute.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor* HOWARD P. DOUB, M.D., *Associate Editor*

THE RESPONSIBILITY OF THE RADIOLOGIST IN THE TRAINING OF THE HOSPITAL INTERN IN FLUOROSCOPY[1]

From the Department of Radiology of the College of Physicians and Surgeons, Columbia University, and of the Presbyterian Hospital, New York City

The topic assigned to me for discussion may appear on the surface to be simple. In reality it opens up a complex problem with far-reaching implications. It seems advisable to begin by making sure of the meaning of three words used in the title, namely, *intern*, *fluoroscopy*, and *training*.

DEFINITION OF TERMS

The interns referred to are those taking general medical, surgical, or rotating services.

The fluoroscope is ordinarily used for the examination of the heart, lungs, and gastro-intestinal tract. Employed as an orthodiagraph, it suffices for the heart. The proper examination of the gastro-intestinal tract and lungs requires also the use of films. Although an experienced observer can detect relatively small lesions by fluoroscopy, the neophyte may demonstrate only certain grosser changes, some of which, however, because of physical conditions or location might be impossible to detect by physical examination. A permanent record for detailed study and for comparison later is lacking. Fluoroscopy is safe only when its limitations are clearly recognized. I have the impression that the term as used in the title refers primarily to the examination of the chest and heart. The fluoroscope is used in the reduction of fractures by interns and other members of the surgical staff in many hospitals. It is a hazardous procedure and those using it must be made fully aware of the danger to their fingers and to the patient's skin. Except in this connection, fluoroscopy in fracture reduction is not part of the problem.

The term "training," to my mind, means more than a mere opportunity to observe. It connotes the development of experience in a series of steps with increasing personal responsibility under supervision; in other words, apprenticeship. Only in this way can real knowledge be acquired.

OBJECTIVE OF TRAINING

The objective of training interns in fluoroscopy must be outlined. An eminent professor of medicine remarked more than fifteen years ago that if he were "coming through" now he would spend a year in radiology for the sake of the training in medicine that it affords. There is no question about the amount of medical knowledge to be acquired in a department of radiology. The objective implied in the title of this discussion, however, seems a little more specific. Many internists and general practitioners fluoroscope the chest of their patients as a routine and some even attempt to examine the stomach. Recognizing its limitations, many of them feel that a routine fluoroscopic survey of the chest is a valuable addition to the physical examination. Therefore, one objective of this training of interns would presumably be to enable them to use the method later in practice more intelligently and with consciousness of its dangers. The proponents of this idea maintain that it would tend to make the intern more familiar with the possibilities of radiologic methods, more sympathetic toward the efforts of well-trained radiologists, and more acutely aware of his own limitations. Could it be attained, this objective would meet with universal approval. Also to be mentioned is the problem of the man who is to practise in a small community where the help of a trained radiologist is not available.

In two States, the Board of Licensure requires a period of training of not less than six weeks in radiologic technic and interpretation.

[1] Presented at the Eighth Annual Conference of the American College of Radiology, Chicago, Feb. 13, 1938.

An official of one of these boards is quoted as having stated that the purpose of the regulation is to prevent practitioners from injuring patients with the x-ray. This is apparently based upon the assumption that the vast majority of medical men will try to operate x-ray machines.

It seems obvious that this question is linked with the future development of radiology. Will the greater part of radiologic diagnosis be done in the offices of internists, surgeons, and general practitioners, and the radiologist be used for special procedures, for difficult cases, and, in general, as a consultant on films made by others? Considerable work of poor quality is being done at the present time in the offices of clinicians. What might be the effect on this trend of the training of interns in fluoroscopy?

OPINIONS OF RADIOLOGISTS

To get some information as to what is being done now, I wrote to over 130 radiologists in all parts of the country, some connected with large teaching institutions and others with smaller community hospitals, and asked them whether or not they were making an attempt formally to train interns in fluoroscopy. The possible significance of this move was mentioned and they were requested to comment on the proposal. One hundred fourteen replies were received in time to be examined. Seven either are not connected with hospitals or made no statement regarding the policy of their institution. In seven hospitals instruction in fluoroscopy is given and in 100 it is not. Three of the seven are affiliated with medical schools for the teaching of undergraduates, three are in smaller cities where there is no medical school, and one was a small specialty hospital. To these should be added another teaching hospital, information concerning which came from the professor of surgery.

In nine other institutions interns have a definite period of their service in the x-ray department but do not do any fluoroscopy themselves. Some of these are specialty hospitals. The length of service varies from one to four months. One radiologist remarked that he was discontinuing the service because some of the ex-interns had purchased machines and stated that they had been trained in radiology at this institution.

I am told that the late Dr. Hickey also tried the experiment of having the hospital interns rotate through the department of radiology—for a period of two months, I think—but discontinued it after two years. I was not able to get any more specific information than that.

In a few places the opportunity is offered interns of staying on in the x-ray department for from one to six months after the regular service is completed. Most of the radiologists in these institutions stated that they were emphasizing the possibilities, limitations, and hazards of diagnostic work with the idea of increasing the intern's respect for it, rather than trying to teach him to do it.

I also asked these radiologists whether they thought interns should be given training in fluoroscopy. Of the 114, nine made no comment, 89 opposed it, and 16 were in favor of it. Nine of the 16 who favored it are connected with hospitals where it is not done, three are doing it, and three now have no hospital responsibilities. Of the seven institutions where interns are given training in fluoroscopy, it seems that the radiologists of three approve the idea, two oppose it, and two did not express an opinion.

It is of interest to note that among the 16 radiologists who favor the training of interns in fluoroscopy, are some prominent teachers of radiology. One well-known teacher believes that internships are too full now to permit this training and that all medical students should be taught to use the fluoroscope just as they are taught the use of the ophthalmoscope. Another professor of radiology offers an elective course in fluoroscopy to fourth-year medical students which practically all of them take. In groups of two, they spend one and a half hours on six consecutive days in the fluoroscopic room and each is required to do one complete gastro-intestinal examination. This radiologist does not look upon this method as instruction in the technic of fluoroscopy but as an attempt to fix the student's attention upon the examination so that he will better understand and sympathize with what the radiologist is trying to do.

Some radiologists expressed sympathy for the intern who expects to settle in a small community where expert help is not available and were taking steps to help him. One well-known teacher of radiology remarked that nothing but good could come from teaching interns fluoroscopy but he does not permit anyone not connected with his department to use a fluoroscope. Another believes that the broader the intern's knowledge the less likely is he to overstep his limitations.

Although opposed to the proposition as

stated, the vast majority of replies emphasize the importance of giving the intern as much information as possible regarding the field of diagnostic radiology, its usefulness, limitations, and dangers. To this end they welcome the interns to formal conferences, to informal consultations, and to the fluoroscopic rooms as observers of the examination of patients in whom they are interested. Many felt that the internship was already too full to include a service in radiology and that not enough time would be available to give the intern anything worth while, that a brief period of training would give the man a false idea of his competence with resulting serious danger to himself and to his patients, and that an increase in the amount of incompetent office radiology would result. A few have the impression that the interns are not interested in taking an x-ray service. Many agreed that an anatomical specialist, such as a chest man or a gastro-enterologist, could acquire enough experience to become well versed in the radiology of his specialty, but pointed out the danger of a temptation to step beyond that field. Some radiologists expressed the opinion that if a clinician wishes to use a fluoroscope or other radiological methods he should have more training than is possible during an internship.

It appears from these letters that the number of medical practitioners who own fluoroscopes or more complete x-ray equipment varies considerably in different communities Some radiologists believe that this will increase, that it would be inadvisable to attempt to stop it, and that every effort should be made to guide this trend, in order to avert the consequences of ignorance. A few feel that an up-to-date clinician, while realizing the limitations of the method, must fluoroscope his patient's chest. A radiologist of large experience stated that a fluoroscope installed in the office of a practitioner usually results in more work referred to the radiologist. A younger man made a similar observation but added that the radiologist must maintain superiority of knowledge. On the other hand, office radiology by the practitioner, in the experience of two other men, usually results in requests for free consultation with specialists.

OPINIONS OF PROFESSORS OF MEDICINE AND SURGERY

To get other points of view, I wrote to 16 professors of medicine and the same number of professors of surgery in medical schools throughout the country, and asked for an opinion as to the advisability of training interns in fluoroscopy. I attempted to set before them the reasons why this problem is brought up for discussion and its significance from the radiologist's standpoint.

Of the 13 professors of medicine who replied, nine are opposed to it, three favor it, and one did not make his opinion clear, although he believes the fluoroscope to be an indispensable part of an internist's equipment. One, who favored it, would limit the training to the heart and lungs; he believes two months' service should suffice but finds it impossible to arrange under present conditions. Another, who favors it, would include all radiology and believes the dangers of incomplete preparation no greater than in any medical training. The fears expressed by those opposed were much the same as those of the radiologists—insufficient training, danger of not recognizing limitations, etc. One, who opposed it, thinks that most interns will not want to use the fluoroscope in their practice, that it would not be fair to make all of them take a service in the x-ray department, and that special arrangements should be made for the interested few. Two mentioned the use of fluoroscopes by members of the medical service independently of the department of radiology.

Of the ten professors of surgery who replied, seven are opposed to the training of interns in fluoroscopy, and three favor it. Those opposed expressed fear of the results of incomplete training, much as did the internists. One, who opposed it, thinks it should be possible for a man who intends to practise in a small community to take an x-ray service of a few months following his regular internship, but a man in a community where specialists are available should not attempt to do x-ray work. It is of considerable interest that, of the 23 clinicians who replied, only two, both surgeons, mentioned the danger of injury from the rays, in contrast to the frequency with which it was mentioned by the radiologists.

CONCLUSIONS

It is quite apparent that a difference of opinion exists among both clinicians and radiologists in regard to the training of interns in fluoroscopy. In two medical schools the professors of medicine and surgery are in disagreement on this question; in another, the

professors of radiology and surgery favor it while the professor of medicine is opposed to it. This difference of opinion exists even among very young medical men, as I found when I questioned a dozen or more.

In attempting to formulate a policy in the presence of such divergence of opinion, it is well to remember that the roentgen method of physical examination occupies a pre-eminent place among diagnostic procedures. Its continual improvement is dependent upon the work of men who devote all their time to it. In general they will do it better than anyone else in their medical community. Anything which would interfere with their interest and activity would hamper the development of radiology, would not be for the good of medicine, and eventually would affect adversely the welfare of patients. But the weakness as well as the strength of radiology is in its great importance in medicine. It must be applied as widely as possible and yet used accurately and safely. To attempt to control its use by edict would be highly inadvisable even if possible. This must be done by education. The radiologist must be alert to learn from his clinical colleagues, must show the young medical man by precept and example the importance of careful, accurate diagnostic work, and discourage inefficient radiology by the medical practitioner.

The problem resolves itself into a question as to whether training an intern in fluoroscopy, or perhaps more extensively in radiology, would give him a false feeling of sufficiency and encourage him to attempt things he should not try to do, or whether it would make him realize both the limitations of the method and of himself, as well as the need for prolonged special training in this field. I would be presumptuous, indeed, to pretend to know the answer to this question. However, I am inclined to agree with those who uphold the proposition that the more a good clinician knows about radiology, the more respect he will have for it and the more he will appreciate good work in it. From the practical standpoint it seems questionable whether real training in fluoroscopy can be satisfactorily integrated with a hospital internship. It certainly should not be attempted in a one-year rotating service. Possibly those who are taking the occasional young man into the x-ray department for from three to six months at the close of the internship have a better solution alike for him who desires orientation from a general medical standpoint, for him who feels he must fluoroscope his patients' chests, and for him who must do some radiology in a small community practice. If it must be done during a hospital service, it would seem to me quite undesirable to take the intern for an hour or two a day or to permit him to have responsibilities elsewhere at the same time that his service in the x-ray department is going on. If this training is to be attempted at all, the intern should become temporarily a member of the department of radiology and should receive as broad an experience as possible. It could not be limited to fluoroscopy alone, as the study of films is necessary to check upon the accuracy of screen observations. The effect on his future conduct will probably be dependent in part upon his personal character and intellectual honesty, and in part upon the skill of his radiological preceptor. The experiments along this line now being carried on in some institutions will be watched with interest; their effect upon young men should be the subject of further study.

In conclusion, I wish to thank the gentlemen who so kindly replied to my letters and to pay tribute to the obvious honesty and sincerity of their opinions.

ROSS GOLDEN, M.D.

ANNOUNCEMENT

AMERICAN CONGRESS ON OBSTETRICS AND GYNECOLOGY

This Congress, sponsored by the American Committee on Maternal Welfare, Inc., will meet in Cleveland, Ohio, Sept. 11–15, 1939. The member organizations of the American Committee on Maternal Welfare, Inc., are the following: American Association of Obstetricians, Gynecologists, and Abdominal Surgeons, American College of Surgeons, American Gynecological Society, American Hospital Association, American Nurses Association, American Protestant Hospital Association, American Medical Association (Section on Obstetrics and Gynecology), American Public Health Association, Catholic Hospital Association, Central Association of Obstetricians and Gynecologists, Chicago Maternity Center, League of Nursing Education, Maternity Center Association of New York, National Medical Association, National Organization for Public Health Nurs-

ing, New England Obstetrical and Gynecological Society, Pacific Coast Society of Obstetrics and Gynecology, Southern Medical Association, U. S. Bureau of the Census, U. S. Children's Bureau, and U. S. Public Health Service.

The purpose of the Congress is to present a program of our present-day medical, nursing, and health problems from a scientific, practical, educational, and economic viewpoint so far as they relate to human reproduction and maternal and neonatal care. This is not in any sense a legislative body and will take no action relative to maternal and infant care. Its purpose is, as clearly stated, to be a Congress for the presentation of scientific material, mostly of factual type.

The five-day sessions are being planned as follows: Mornings, special programs for each organization group and sub-groups; afternoons, joint sessions of general interest to all members attending; evenings, meetings for all members, with speakers of national prominence. There will be scientific and educational, as well as technical and commercial exhibits.

Fred L. Adair, M.D., Chicago, is *General Chairman;* Robert D. Mussey, M.D., Rochester, Minn., *Vice-chairman;* Sara B. Place, Chicago, *Secretary;* Rudolph W. Holmes, M.D., Chicago, *Treasurer,* and Frederick H. Falls, M.D., Chicago, *Assistant Treasurer.*

Further information may be obtained at the Central Office, 650 Rush Street, Chicago, Illinois.

COMMUNICATION

PRESENTATION OF A MEDAL TO DR. BELOT IN PARIS

On Dec. 13, 1938, at the Marcellin-Berthelot Center in Paris, Dr. J. Belot was presented with a medal by his many friends and students in honor of his contributions to radiology as an investigator and a teacher. Dr. Belot is the Director of the Department of Radiology at the Saint-Louis and the Villejuif Hospitals in Paris. Leader of the French delegation, many Americans had the pleasure of meeting him at the Fifth International Congress of Radiology, in Chicago, in September, 1937. The presentation took place before a large assembly which included radiologists from several foreign countries as well as his colleagues in France, professors of the faculty of medicine, and doctors from the various Parisian hospitals. A number of laudatory speeches were made, outlining Dr. Belot's life and his career as a radiologist.

His American friends wish to add their congratulations to those of his European colleagues upon this well deserved honor.

IN MEMORIAM

We have taken time for the careful preparation of a biographical sketch of Dr. Childs, together with a bibliography of his contributions to medical literature, designedly. We seldom publish an obituary notice, believing such sad reminders are best left to the regular channels; when we do vary from this rule it is with the purpose of letting our readers derive information as well as inspiration from the lives of their departed friends.

SAMUEL BERESFORD CHILDS, M.D.
1861–1938

Samuel Beresford Childs was born Nov. 5, 1861, in East Hartford, Connecticut, the son of Seth Lee and Juliet Wood Childs. The simple relation of the chronological events and incidents of his life is a poor substitute for having known the man. Those who were fortunate enough to have met and talked with him, however briefly, must cherish the impression of a life full, rich, kindly, and valuable; one whose contact was worth having and which enriched the world by simply having been.

Dr. Childs' primary and secondary school education was obtained in Hartford. In 1883, he graduated from Yale University with the degree of Bachelor of Arts, and in 1887, he obtained the degree of Doctor of Medicine from the New York University Medical College. His internships were at the Out-patient Department of the Chambers Street Hospital, New York (1887), and as resident in the Hartford (Connecticut) Hospital (1887–1888). Doctor Childs practised medicine in Hartford from 1888 to 1895, during which time he married Henrietta Willette, of West Hebron, New York (1890) In 1895, he went to Texas because of pulmonary tuberculosis. On Dec. 15, 1896, his son, John Wood Childs, was born. In 1898 Dr. Childs began the practice of medicine in Denver, and in November, 1899, he was elected to membership in the Denver and Arapahoe Medical Society. Shortly after that he was

given the Chair of Anatomy at the University of Denver Medical College, which later became the Denver and Gross Medical College, which in turn was absorbed by the University of Colorado Medical School.

In 1906, his wife died, and in 1908 he married Anne Starling, of Henderson, Kentucky. A second son, Samuel Beresford Childs, Junior, was born Jan. 14, 1910. The second wife died April 12, 1935, and about eighteen months later Dr. Childs married Mrs. Nan Bullione Palmer, who, with his sons and three grandchildren, survive him.

About 1928, he developed high blood pressure. Although this condition responded to medical therapy, he had occasional disturbances which probably influenced him to retire from active practice in August, 1937. He died May 21, 1938, of bronchial pneumonia.

Dr. Childs was one of those who became interested in the x-ray soon after it was announced, and as early as 1900 he began employing it in his practice. By 1902 he had obtained a Waite and Bartlett static machine, had studied skin therapy under Dr. Pusey in Chicago, and had spent some time with Mr. John McIntosh who was the demonstrator for the Waite and Bartlett Company. After his return from Chicago he specialized in radiology, and from that time on he devoted his energies to improvement of technic and development of skill in diagnosing and treating disease by the roentgen ray.

His interest in radiology made him a pioneer in that field and prompted him to make constant contributions to medical publications. A partial bibliography of his work is appended. On Aug. 14, 1902, he had an unique experience. He made a roentgenogram of the right kidney of a patient, with an exposure of fifteen minutes. When he related this incident to the interviewer several years ago, his face took on a glow of combined humor and whimsicality. He said, "I put the plate in the developer, and waited. After what I thought a reasonable time, I looked at it, but I could see nothing. So I rocked the pan, for—oh, what seemed to me about an hour; anyhow, until I was disgusted and put the plate in water and left the dark room. I ordered new developer, made it up, and put the plate in it. This was different: in about two or three minutes I began to see a shadow. When it was dark enough I finished the dark room manipulation. Later when I studied the dry plate, I saw not only the outline of the kidney, as I expected, but another shadow which I interpreted to be a stone in the pelvis. I reported accordingly to the physician, Dr. W. A. Jayne, and he confirmed the diagnosis at operation later."

Dr. Childs was an early advocate of the lateral as well as anteroposterior roentgenogram to determine the position of fractures.

Dr. Robert Levy recalled an instance illustrative of Dr. Childs' ever-present willingness to improve his own technic as well as help others to do the same. In 1905, a patient was referred to Dr. Levy for removal of a foreign body from a bronchus. The roentgenogram revealed the object, but there was doubt as to the exact location and especially as to the particular bronchus in which it lay. To orientate himself for bronchoscopy, Dr. Levy obtained a cadaver and injected the bronchial tree *in situ* with an opaque medium. Dr. Childs made a roentgenogram of the injected cadaver thorax, which Dr. Levy studied carefully, comparing it with the one of the living patient. The bronchoscopic removal was successful.

Dr. Childs was a member of the Yale baseball team while a student there, and later played professional baseball as a member of the Hartford team in the National League. He and Connie Mack were very close friends. In later years he took up golf; also, he loved to hunt and fish.

Prior to his retirement from active practice in August, 1937, Dr. Childs had won many honors for his years of medical service. He served the Denver County Medical Society as treasurer for a term, as vice-president in 1916, as president in 1917, and as trustee from 1918 until August, 1937. For a number of those years he was chairman of the board of trustees. He was vice-president of the Colorado-Yale Association in 1909, and president in 1911. He was president of the staff of St. Luke's Hospital (Denver) 1923–1925, of the American College of Radiology 1925–1926, of the Colorado State Medical Society 1928–1929, and of the American Medical Golfing Association. He was the first President of the Denver Radiological Club. At the time of his death he was a member of the staff of the following hospitals, all of Denver: St. Luke's, St. Joseph's, Mercy, Denver General, Colorado General, and National Jewish. He was a member of the Denver County Medical Society, the Colorado State Medical Society, the American Medical Association, the Denver Clinical and Pathological Society, the American Roentgen Ray Society, the Radiological Society of North America, the American College

of Radiology, the Denver Radiological Club, the Colorado-Yale Association, and Professor emeritus of Roentgenology of the University of Colorado Medical School.

JOHN S. BOUSLOG, M.D.

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BOOKS RECEIVED

Books received are acknowledged under this heading, and such notice may be regarded as an acknowledgment of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

SILICOSIS AND ASBESTOSIS. Edited by A. J. LANZA, M.D., Assistant Medical Director, Metropolitan Life Insurance Company; Chairman, Industrial Hygiene Committee of the New York Tuberculosis and Health Association. Contributors: R. R. Sayers, A.M., M.D., Senior Surgeon, U. S. Public Health Service; Chief, Division of Industrial Hygiene, National Institute of Health, formerly Chief Surgeon, United States Bureau of Mines; Eugene P. Pendergrass, M.D., Professor of Radiology, Medical School, University of Pennsylvania; Professor of Radiology, Graduate School of Medicine, University of Pennsylvania; Associate Director, Department of Radiology, Hospital of the University of Pennsylvania; S. Roodhouse Gloyne, M.D., D.P.H., Pathologist, Pathological Laboratories and Research Institute, The London Chest Hospital; Leroy U. Gardner, M.D., Director, Saranac Laboratory for the Study of Tuberculosis; E. L. Middleton, M.D., D.P.H., H. M. Medical Inspector of Factories, London, England. A volume of 439 pages. Published by Oxford University Press, New York, 1938. Price: $4.25.

ORTHOPEDIC APPLIANCES—THE PRINCIPLES AND PRACTICE OF BRACE CONSTRUCTION FOR THE USE OF ORTHOPEDIC SURGEONS AND BRACE MAKERS. By HENRY H. JORDAN, M.D. Foreword by E. G. Brackett, M.D., Editor of the *Journal of Bone and Joint Surgery.* A volume of 411 pages, with 176 illustrations. Published by Oxford University Press, New York, 1938. Price: $4.00.

BOOK REVIEWS

DIAGNOSTICO DOS ANEURYSMAS DA AORTA THORACICA (Diagnosis of Aneurysms of the Thoracic Aorta). By GERALDO DE ANDRADE, Physician to Pedro II Hospital, Chief of Clinic of the Portuguese Hospital, and member of the Staff of the Medical Faculty of Recife, and AGUINALDO LINS, Chief of the Radiological Service of the Faculty of Medicine of Recife. Avolume of 328 pages, with one plate, 40 halftones, and 52 roentgenograms. Published by Companhia Editora Nacional, São Paulo, Brazil. Price not stated.

The reader is offered an orderly presentation of the entire subject of thoracic aneurysms, commencing with definitions, statistical data, constitutional and congenital factors, proceeding to the physical examination in most minute detail, and a long analysis of the symptomatology. It seems hardly possible for the authors to have omitted a single one of the numerous signs and symptoms described anywhere in the literature. Although only about twenty-five pages are devoted to the purely radiological aspects of the subject, the radiological findings are worked into the text in every appropriate place. The numerous radiographic illustrations add much to the value of the text. The authors deserve commendation for the thoroughness of presentation of a disease of which they enjoy a very rich material.

RÖNTGENDIAGNOSTIK DER KNOCHEN- UND GELENKKRANKHEITEN (Roentgen Diagnosis of Diseases of the Bones and Joints). By Prof. Dr. ROBERT KIENBÖCK, Vienna. Vol. 5 (Section on Joint Diseases, pages 451–1049), Rheumatoid Joint Tuberculosis. With

610 illustrations in the text. Published by Urban & Schwarzenberg, Berlin, 1938. Price: R.M. 60.

This volume of 598 pages is essentially an atlas of cases of various types of bone and joint lesions which are considered by the author as tuberculous. The first half of the volume is devoted to what he calls "*Rheumatoide Gelenkstuberkulose.*" This is the condition long known in this country as Poncet's *rheumatisme Tuberculouse.* Many of us have not been willing to recognize this condition as an entity; however, for those looking for support for this thesis this work should be a great help.

The second half of the volume is devoted to Destructive Joint Tuberculosis. Again numerous case reports are given, in more or less detail, together with their roentgenograms, and much material is thereby presented.

The volume is another of those contributions by the same author presenting essentially a series of atlases of diseases of the bones and joints and as such is an important addition to the series. It covers this subject with a wide variety of case reports and furnishes material for an extensive study of this condition. This section completes the volumes on joint conditions.

PRIMARY CARCINOMA OF THE LUNG. By EDWIN J. SIMONS, M.D., Member of the Staff of St. Gabriel's Hospital, Little Falls, Minn., and Lymanhurst Health Center, Minneapolis, and Visiting Consultant in Medicine, Minnesota State Sanatorium, Ah-Gwah-Ching, Minn. Foreword by J. Arthur Myers, M.D., Professor of Medicine and Preventive Medicine and Public Health, University of Minnesota. A volume of 263 pages, 30 illustrations, numerous tables, and two color plates. Published by the Year Book Publishers, Chicago, Ill., 1937. Price: $5.00.

This is the most comprehensive review of the literature concerning primary carcinoma of the lung that has appeared since Adler's work in 1912. It is remarkable in that it has been written, and very ably so, by a rural practitioner whose interest in the subject was aroused by the occurrence in his practice of two cases within two years.

Facts and figures have been presented which prove definitely a real and not merely an apparent increase of pulmonary carcinoma . Concerning etiology, it has been found that various ones or combinations of the fourteen etiologic agents most frequently referred to in the literature may be the cause of isolated cases, or may have been to some extent responsible for its general increased frequency. Histologically the cases may be composed of any of the following three fundamental types of cells and all cases may be grouped under one or another of three headings: (1) squamous cells, (2) adenocarcinomas, and (3) undifferentiated round- or spindle-cell growths. It is now generally conceded that all bronchiogenic or pulmonary carcinomas originate from one parent cell—the undifferentiated basal cell of the bronchial epithelium. The discussion of the clinical features begins with an analysis of 5,921 cases as to sex incidence. The analysis of the various symptoms is based on 1,456 cases.

The various physical signs are classified and discussed with a view to emphasizing their importance. Different classifications of the x-ray features of the disease are considered and the grouping of the tumors roentgenologically as either hilar or peripheral is advocated. Under diagnosis are recapitulated all the symptoms, physical findings, and results of special procedures considered most indicative of pulmonary cancers. A dissertation of the treatment considering symptomatic measures, irradiation, and surgery concludes the study.

While this has been said to be a book by a general practitioner for general practitioners, it is decidedly more than that and many in the specialist class should be grateful for this volume.

A HANDBOOK OF ROENTGEN AND RADIUM THERAPY. By A. J. DELARIO, B.A., M.D., Radiologist, St. Joseph's Hospital, Paterson, N. J., and Community Hospital, Montclair, N. J. A volume of 362 pages, illustrated with numerous engravings, graphs and tables, and one colored plate. Published by F. A. Davis Company, Philadelphia, 1938. Price: $8.00.

The author has assembled in book form information which has proved valuable to him and has added charts, graphs, and tables of his own. The absorption of roentgen rays is discussed in five and a half pages, the physical and chemical changes produced in tissues by roentgen rays in one and a half pages, the recovery of tissues in seven pages, radium therapy in twenty-one pages, the bibliography in fifteen pages. The figures and charts arranged to explain the physics of roentgen and radium waves and their practical applications occupies ninety-

five pages. The third part, on end-results, takes 138 pages.

This notebook contains many facts. Its contents, however, seem to be sketchy, superficial, incomplete, and largely non-critical. The material presented is easily available to the radiologist or student of radiology in better and more comprehensive texts.

SHORT WAVE THERAPY. Second English Edition. By. E. SCHLIEPHAKE, Dozent of the University of Giessen. Authorized English translation by R. KING BROWN, B.A., M.D., D.P.H. A volume of 296 pages, with 148 illustrations. Published by The Actinic Press, Ltd., London, 1938. Price: 21/- net.

The second edition of this work is divided into eight sections, as follows: nature and development, medical uses, the short wave method, experimental section, pathologic processes, treatment of human diseases, general conclusions, and appendix. The text perpetuates many of the erroneous conclusions found in the first edition. The author still believes in selective heating effects and in specific biologic and bactericidal effects of short radio waves. This is contrary to the generally accepted views in this country and is not in agreement with the conclusions of the Council on Physical Therapy of the American Medical Association. In the clinical section are many enthusiastic claims concerning the value of short wave diathermy. Schliephake's book is recommended only to those enthusiasts who desire a complete set of books on the subject of short wave diathermy. To such readers it is suggested that Schliephake's conclusions be taken with a grain of salt.

PYRÉTOTHÉRAPIE (Fever Therapy). By CHARLES RICHET, JEAN SURMONT, and PIERRE LE GÔ. A volume of 195 pages, with illustrations. Published by Masson et Cie, Paris, 1938. Price: 50 francs.

The senior author (Richet) of this new and interesting French text on fever therapy created a very favorable impression upon his American listeners when he spoke at the International Congress on Fever Therapy held in New York in 1937. As was to be expected, therefore, the text-book is an excellent exposition of the subject. As seems often to be the case with French publications, the authors are long on theory and a little short on certain facts. There is not enough presentation of controlled clinical studies on the clinical action of fever therapy.

The text is divided into three sections, the first dealing with biologic data, the second with technic, and the third with clinical results. In their conclusions the authors state that they have attempted to combine the facts and theories presented in a number of congresses, articles, and communications concerning fever therapy. In this attempt they have succeeded. The presentation is a complete and logical summary of the subject of fever therapy and is to be recommended to all physicians who are interested in this subject.

THE MEDICAL APPLICATION OF SHORT WAVE CURRENT. By WILLIAM BIERMAN. Including a discussion of its physical and technical aspects by MYRON M. SCHWARZSCHILD. A volume of 379 pages, with 85 illustrations. Published by William Wood and Company, Baltimore, 1938. Price: $5.00.

This new text-book on short wave diathermy is undoubtedly the best book on this subject in English. Like a number of other books in this field, an extremely large portion of the text is devoted to rather complicated physical aspects of the problem. Although it is true that the physical fundamentals of the subject are highly important, and although it is true that the physical aspects of short wave diathermy are more simply and lucidly presented in this text than in any previous text on the subject, the average practitioner of medicine will not care to make the effort to comprehend equations like the following, which appear in Table V:

$$R_e = \frac{K}{\frac{p}{2} \quad \frac{2}{Kp + Sp}} \qquad Q_e = \frac{K}{\frac{p}{2} \quad \frac{2}{Kp + Kp}}$$

Such equations leave the reviewer gasping and bewildered, and he is inclined to believe that there are other physicians like him. Nevertheless, Schwarzschild has unquestionably done an excellent job in presenting a difficult subject in a highly scientific manner.

The other two-thirds of the book are concerned with history, temperature determinations, physical responses, specificity, technic, introduction to clinical applications, and clinical applications. The book is well illustrated,

the context is presented in very readable style, and in a highly authoritative manner. There is an extensive bibliography appended. The volume can be recommended most highly and should be in the hands of every physician who is interested in the subject of short wave diathermy.

TRAITE D'ELECTRORADIOTHERAPIE (Treatise on Electroradiography). By L. DELHERM and A. LA QUERRIERE, with 88 collaborators. Two volumes which contain 2018 pages, with 450 figures. Published by Masson et Cie, Paris, 1938. Price: 480 francs.

This voluminous French work, edited by Delherm and La Querriere with eighty-eight collaborators, is a most interesting presentation. Following the preface by Prof. d'Arsonval, appears an historical sketch by La Querriere, Delherm, and Stronzer. The text is so extensive that a mere recitation of the headings of the chapters which appear in its two large volumes would consume more space than is used in the average review. Suffice it to say that the first volume deals with fundamentals, action of electric currents and radiations, electric accidents and dangers, and the fundamentals of the biologic action of roentgen rays and radio-active bodies. A second portion of the first volume is devoted to the clinical aspects of the subject, discussing diseases of the nervous system, electro-diagnosis, chronaxy, electroradiotherapy in various diseases with special reference to the nervous system, muscular diseases, atrophic disorders, endocrine glands, and diseases of nutrition. The second volume is divided into seventeen additional sections, starting with a section on diseases of infancy in which rickets, spasmophilia, tetany, acrodynia, spasmo-paralytic affections, and infantile myotonias and hypertonias are discussed. Following this are sections on diseases of the skin, respiratory tract, cardiovascular apparatus, blood, lymphatics, digestive tract, genito-urinary tract (male and female), tropical diseases, foreign bodies, surgical lesions, diseases of the ear, nose and throat, ocular diseases, and diseases of the mouth. The final section deals with legislation and medical jurisprudence in relation to electroradiotherapy. This authoritative and extensive work can be recommended to anyone interested in this particular field of medicine.

PRAXIS UND ERGEBNISSE DES KURZWELLENHEILVERFAHRENS BEI ALLGEMEINTHERAPEUTISCH RESISTENTEN ERKRANKUNGSFORMEN (Practice and Results with Short Wave Treatment Methods in Diseases Resistant to General Therapeutic Methods). By. L. H. STIEBÖCK. A monograph containing 67 pages, with illustrations. Published by Urban & Schwarzenberg, Berlin, 1937. Price not stated.

(NOTE: This small monograph, taken from *Ergebnisse der gesamten Medizin*, by Prof. Dr. Th. Brugsch.)

This short monograph presents rather enthusiastically the author's personal views concerning the value of short wave therapy (usually spoken of in this country as "short wave diathermy") in the treatment of numerous diseases. The very extensive list of diseases alone leads one to be somewhat dubious concerning the results mentioned. For example, one might question the author's claim that in 44 cases of otosclerosis, 25 of the patients were improved, and that in 43 cases grouped together under the heading "myositis ossificans nonprogressive, myalgia and lumbago," 39 of the patients were cured, four were improved. To those who are interested in short wave diathermy, this monograph may be of interest; however, the reviewer is somewhat skeptical concerning the statistical data presented.

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APPARATUS

The Dependence of the Ionization Current on Volume of Small Ionization Chambers. U. Henschke. Strahlentherapie, **62,** 614, 1938.

The author investigated the relation between volume of a small ionization chamber and the ionization current. He describes his experimental setup and discusses the possible sources of error. He then relates the measurements taken with a sphere chamber, with the pressure within the chamber varying from 3 to 750 mm. H., with a cylindric chamber, and with plate condensers. The potential range was from 40 to 170 kv. beginning with no filter up to 1 mm. Cu. He found that there was very little deviation from the proportionality between volume and ionization current for the chambers used. He feels that except for the experiment with varying pressure this was surely within the limit of error. The influence of the wave length detected in his measurements is explained by the fact that the chamber material used had a slightly larger electron emission than air.

ERNST A. POHLE, M.D., Ph.D.

Five Years' Experience of Modern Shock-proof and Ray-proof Containers for Roentgen Therapy Tubes. R. Thoraeus. Acta Radiol., **19,** 174–184, May, 1938.

The uniformity of operating conditions and of equipment prevailing in Sweden, combined with regular semiannual check-ups of the physical and technical factors by direct measurements, allows more definite conclusions than are possible in other countries. Special attention is devoted to the economic factors, and a formula has been developed to express the cost of modern shock- and ray-proof container equipment distributed over a number of years.

The formula is $A = N(C - P)$ in which A signifies $\frac{}{T}$ the cost amortization; P, price of the tube; T, tube life in hours; N, hours of operation per year, and C, tube cost per hour of operation.

The author takes into consideration that, for practical reasons, any x-ray therapy unit will be more or less obsolete after from 12 to 15 years.

ERNST A. SCHMIDT, M.D.

Experiments with a Condenser Discharge X-ray Tube. K. H. Kingdon and H. E. Tanis, Jr. Physical Rev., **53,** 128–134, Jan. 15, 1938.

A tube with a 4.5 cm. tungsten disk anode and a pool of mercury for cathode permitted condenser discharges of several hundred amperes at 105 kv., lasting about four microseconds. Each shot yielded about 3.5 r at 11.5 cm. distance.

At this rate, about 40,000,000 r per min., they found Victoreen r meter readings incorrect because of recombination of ions. They found a photographic film about equally blackened by 0.3 r whether delivered in five microseconds or by discharge of the same condenser through a Coolidge tube at one ma. current. A difference in biologic effect (wheat seeds, *Drosophila* eggs, *Aspergillus* spores) could not be demonstrated. Some arguments in regard to columnar and volume density of ions in relation to biologic effect are presented.

R. R. NEWELL, M.D.

Presentation of Several Pulmonary "Biotomes" Taken with the Apparatus of Bocage. Léon-Kindberg and L. Gérard. Bull. et mém. Soc. de Radiol. méd. de France, **26,** 217–221, April, 1938.

Several cases are presented illustrating the value of radiographs of single planes of the thorax. The authors have had excellent results with the apparatus of Bocage, having taken over 900 films with uniformly successful results.

S. R. BEATTY, M.D.

The New Siemens Body Cavity X-ray Tube with Pointed Anode. Zimmer. Strahlentherapie, **62,** 731, 1938.

The author describes a new x-ray tube with a pointed anode suitable for insertion into body cavities. This construction permits contact irradiation. Two illustrations of the new tube are shown as well as two isodose curves. Since the dosage measurements for this type of tube are somewhat difficult, calibration curves are furnished by the manufacturer. At a distance of 2 cm. the output is approximately 70 r/min.

ERNST A. POHLE, M.D., Ph.D.

The Biotome: Presentation of the Apparatus. M. A. Bocage. Bull. et mém. Soc. de Radiol. méd. de France, **26,** 210–216, April, 1938.

The biotome is an apparatus designed to secure radiographically views of a single anatomic plane of a subject, the plane being parallel to the film, by means of a simultaneous circular motion of the tube and film in opposite directions during the exposure.

At about the height of the eye the tube is fixed to a connecting rod joining the rims of two identical vertically mounted wheels. The wheels are also connected by a belt which is in turn connected to an electric motor. The axis of one wheel is prolonged as a shaft which transmits, by means of a crank at its end, a rotary motion to a frame holding a cassette at the other end of the apparatus.

The cranks moving the tube and cassette are at an angle of 180 degrees to each other. The tube moves in a circle of 40 cm., the cassette describes a circle varying from 4 to 8 cm. The focal film distance is 140 cm.

The plane of the cassette is maintained parallel to the plane of rotation of the tube.

The distance from the plane of the subject to the film varies from 12.7 cm. to 23.3 cm. This distance is maintained by a perpendicular radiolucent support against which the subject, seated between the tube and film, is placed. This support and the seat can be moved up and down, and also toward or away from the film, a graduated scale determining the proper distance so

that the desired plane of the body is at the required distance from the film.

The exposure is made while the tube and cassette are rotating at the rate of about two turns per second. The exposure time varies from one-half to several seconds and should correspond to an even number of turns of the moving system.

The thickness of the stratum which is not blurred out and is, therefore, seen clearly is about 2 mm.

The circular motion has distinct advantages over a rectilinear motion and is much easier to accomplish than the theoretically superior spiral motion. The circular shadow produced in the center of the film cannot be confused with the shadow of any organic structure and is usually not noticeable.

S. R. BEATTY, M.D.

The Problem of "High Current" X-ray Apparatus. C. H. Esser and P. Ott. Strahlentherapie, 1938, **62,** 380.

Under high current x-ray apparatus the author understands a machine operated at 200 kv. and 15–30 ma. tube current. He describes his measurements of the quality, output, and depth doses carried out on an apparatus of this type. It is concluded that the main advantage of this type of x-ray apparatus lies in the fact that a high output is available, permitting treatments at long focal skin distances with a higher depth dose in a time short enough to avoid discomfort to the patient.

ERNST A. POHLE, M.D., Ph.D.

Electrostatic Generator Operating under High Air Pressure—Operational Experience and Accessory Apparatus. D. B. Parkinson, R. G. Herb, E. J. Bernet, and J. L. McKibben. Physical Rev., **53,** 642–650, April 15, 1938.

Improvements and experience with the Wisconsin electrostatic generator (van de Graaf type) and multisection tube are described (*Physical Rev.*, **51,** 75, 1937). Operating under eight atmospheres air pressure with $C Cl_4$ or $C Cl_2F_2$ vapor, they reach about 2.5 million volts. They are being used for acceleration of positive ions, not for x-ray.

R. R. NEWELL, M.D.

A Simple Procedure for Radiography of the Optic Canal. A. Bardy. Bull. et mém. Soc. de Radiol. Méd. de France, **8,** 107, 108, February, 1938.

The author secures radiographs of the optic canal simply, by so positioning the patient radioscopically that the shadow of the tip of the nasal bones lies in the center of the opposite orbit.

S. R. BEATTY, M.D.

The Greinacher "Spark" Counter for the Measurement of Very Small Quantities of Roentgen and Radium Rays. A. Leichti. Strahlentherapie, 1938, **62,** 343.

The author describes the Greinacher "spark" counter and its adaptation to the measurement of very small quantities of roentgen rays and radium. The differences in construction between this counter and the well-known Geiger counter are mentioned. The sensitivity of the apparatus is so high that 10^{-5} r/second corresponds to approximately 150 quanta/minute.

ERNST A. POHLE, M.D., Ph.D.

ARTHRITIS

Chronic Arthritis of the Shoulder. John G. Kuhns. New England Jour. Med., **219,** 516–520, Oct. 6, 1938.

In a review of 1,765 cases of atrophic arthritis the author found 165 with shoulder involvement, and in 641 cases of the hypertrophic form, the shoulder was involved in 42 cases. Symptoms and clinical findings are discussed.

Roentgenographic findings are late. In the atrophic form there is atrophy of the bone together with disappearance of the articular cartilage. Calcification may appear in the articular cartilage. The hypertrophic form is characterized by osseous proliferation. Areas of absorption resembling cysts are sometimes seen in the head of the humerus. Often the most extensive changes are seen in the acromioclavicular joint.

JOHN B. MCANENY, M.D.

A New Surgical Procedure in Acute Infectious Arthritis. Herbert E. Hipps. Texas St. Jour. Med., **34,** 276–284, August, 1938.

Acute infectious arthritis, the author believes, is a primary hematogenous osteitis of the epiphyseal end of a bone, generally streptococcic, which spreads to the hyaline cartilage lining the end of the bone and then into the joint cavity. Clinical, laboratory, pathologic, and roentgenographic evidence is given to support this contention.

The treatment advocated, in early cases, consists of draining the bone near the acute arthritic joint by means of drill holes into the bone, using a drill of from $^1/_4$ to $^3/_8$ in. in diameter. No drains are used and a plaster cast is applied immediately for immobilization. Care is taken to avoid entering the joint, and, in children, penetration of the epiphyseal line is also avoided since it results in shortening of the limb.

Sixteen cases of acute non-articular inflammation are reported in which this operation was done. Serosanguineous fluid under pressure was obtained in early cases. Cases gave excellent results as early as from three to twelve days and positive cultures. The temperature dropped rapidly, pain left within one week, and the joint was practically well without pain or stiffness in from three to four weeks. Results in cases of longer standing were less satisfactory.

Included also are 12 cases of osteoperiosteitis of the os calcis similarly treated in order to hasten recovery. The observation, by the author, that a large number of cases of arthritis gave a history of painful heel (88 out of 137) suggested to him that the condition was primarily an osteitis, and led to the development of this operation.

JOHN M. MILES, M.D.

BACKACHE

Orthopedic Aspects of Pain in the Lower Back. Louis W. Breck. Southwestern Med., **22,** 1–4, January, 1938.

Of all types of low back pain, affections of the lumbosacral and sacro-iliac areas are the most important lesions, largely because they are the most common. The causes may be either strain or infection. Pain in the morning and with change of weather is due, usually, to an arthritis. Pain at the end of the day is due to a chronic strain.

In lumbosacral lesions flexion of the lumbar spine is limited in all directions. Spasm of the muscles may cause a twist of the spine, and there is tenderness in the lumbosacral region. X-rays may be negative or may show facet changes, bridging of the ligaments, osteophytes, or narrowing of the lumbosacral intervertebral space.

Sacro-iliac pathology reveals tenderness over the affected joint, limitation of straight leg-raising, and muscle spasm which may amount to a sciatic scoliosis. The x-ray may show marginal sclerosis, true hypertrophic arthritis, or bridging of the ligaments. It is possible to have involvement of both these areas, especially with arthritis.

Other causes of backache include postural conditions, fracture, posterior protrusion of the intervertebral disk, tuberculosis, typhoid spine, osteomyelitis, senile osteoporosis, spondylolisthesis, hemangioma, giant-cell tumor, osteogenic sarcoma, myeloma, metastatic carcinoma, intraspinal tumors, and gynecologic pathology.

The treatment of lumbosacral and sacro-iliac lesions in the acute stage consists of complete bed rest on a hard bed, heat, strapping, and traction to both legs. In chronic cases limitation of activity, heat, and a belt are advised. Foci of infection should be eliminated. X-ray therapy to the affected joint is often useful. If conservative treatment fails operative fusion of the affected joint may be indicated.

M. John Miles, M.D.

BIOLOGIC EFFECTS OF RADIATION

Radiosensitivity and Cell Division. W. Luther. Strahlentherapie, **62,** 436, 1938.

The author exposed frog eggs immediately after fertilization at intervals of 6, 10, and 15 minutes for five or six minutes to radium rays at the rate of 20 r/min. By plotting a death curve for all eggs injured before the gastrula stage, it appeared that with exposures at intervals of 15 minutes at 20° C. the death curve is very similar to that obtained for roentgen rays at 11° C. The sensitivity of the irradiated eggs is apparently dependent only on the stage of mitosis. The absolute age of the germ during the first four or five divisions has no influence on the reaction to irradiation. Immediately after the first division the susceptibility of the eggs is very low. In the prophase of the next division it increases, drops again during or shortly after the metaphase to a second minimum. This same phenomenon was also seen in irradiated eggs of the sea urchin. During the telophase the susceptibility reaches its peak but drops immediately after. Eggs which survive the gastrula stage show disturbances in growth and necrosis. There is considerable individual variation in this reaction because some eggs show no change at that stage, while others are severely injured.

Ernst A. Pohle, M.D., Ph.D.

The Biologic Effect of Roentgen Rays. J. A. Crowther. Strahlentherapie, **62,** 569, 1938.

This is the text of the twentieth Silvanus Thompson memorial lecture presented before the annual meeting of the British Radiological Society on Dec. 10, 1937. It is reprinted in English in the *British Journal of Radiology,* **11,** 123, 1938.

Ernst A. Pohle, M.D., Ph.D.

BONE DISEASES (DIAGNOSIS)

Puffy and Cystic Appearance of the Lower Jaw of a Sengalese. Castay. Bull. et mém. Soc. de Radiol. méd. de France, **26,** 280–282, April, 1938.

The jaw of a Sengalese soldier, which had been increasing in size for two years, was shown roentgenographically to have a soap-bubble, cystic appearance without periosteal rupture or proliferation. The other bones of the skeleton were not involved. The author believes the condition to be a localized osteitis fibrosa cystica.

S. R. Beatty, M.D.

Osteoporosis in Hyperthyroidism. Elmer C. Bartels and Gilbert E. Haggart. New England Med. Jour., **219,** 373–378, Sept. 15, 1938.

The authors bring to notice once more the osteoporosis occurring in hyperthyroidism. The condition usually manifests itself only after the hyperthyroid state has existed for some time. Necropsy shows gross osteoporosis and microscopically there is extensive osteoclastic resorption. Roentgenographically the changes are easily seen. Two cases of fracture occurring in elderly patients are presented. The degree and rate of decalcification depends on the duration of the disease, the rate of calcium loss, and calcium intake.

John McAneny, M.D.

Brodie's Abscess and its Differential Diagnosis. James F. Brailsford. British Med. Jour., 119–123, July 16, 1938.

The author gives an account of Brodie's first description of chronic abscesses in the tibia, in eight patients, one of whom had an amputation after 12 years of suffering. The specimen showing a typical cavity about the size of a walnut.

In analyzing his own series of 42 cases he makes the following conclusions: incidence, male to female—2 : 1; age period, 11 to 30 years, and symptoms are

intermittent with long remissions. One-third of the lesions were in the lower end of the tibia, the epiphysis being perforated only rarely; eight cases had a history of bone injury preceding symptoms. Symptoms are insidious as compared with those of acute osteomyelitis.

Roentgenographic signs vary with the duration and intensity of the lesion. The more indolent the course, the more typically cystic is the cavity. The more acute the course, the less well defined and the larger is the cavity. Roentgenographic localization is essential before surgery. The cavity will persist two or three years after evacuation. Differential diagnosis must be made with consideration of tuberculous abscess, gumma, simple bone cysts, osteoclastoma, sarcoma, and endothelial myeloma.

Q. B. CORAY, M.D.

Primary Hemangioma Involving Bones of the Extremities. Charles F. Geschickter and I. H. Maseritz. Jour. Bone and Joint Surg., **20,** 888–900, October, 1938.

Uncommon as this condition is, the number of reported casés is rapidly mounting, and to that number four cases are here added. The similarity between giant-cell tumor and hemangioma of bone is noted and the differential features are stressed. Both conditions show trabeculations but those of the hemangioma are coarser. The hemangioma often shows a punched-out area in the bone beyond the main defect. Biopsy is imperative because of the malignant nature of some of these growths.

JOHN B. MCANENY, M.D.

Generalized Form of Paget's Disease with Diffuse Involvement of the Small Bones of the Extremities. P. Harvier, J. Mallarmé, and Guy Ledoux-Lebard. Jour. de radiol. et d'électrol., **22,** 60–65, February, 1938.

The authors report a case of Paget's disease with generalized involvement, including many of the small bones of the foot and hand. The lesions of the skeleton are described in detail. The lesions of the phalanges seemed to involve chiefly the epiphyseal portions where they produced the appearance of parallel lines, as of a grill.

S. R. BEATTY, M.D.

BREAST CANCER

Chronic Mastitis and Breast Cancer: A Family History of Five Sisters. W. Sampson Hadley. British Med. Jour., 113–116, July 16, 1938.

The author gives the history of five sisters, descendants of a cancerous mother and grandmother, who have been under his care for 19 years. All sisters had radical breast amputations. Two had simple mastectomies. Two of the sisters have died of breast cancer: the other three are now well. In advising the family he was guided by the following conditions: (1) chronic mastitis is a precancerous condition; (2) chronic mastitis is often amenable to x-ray treatment without operation and consequently deep x-ray treatment may be an effective prophylactic against cancer; (3) protection by x-ray is neither absolute nor permanent and cases so treated should be re-examined every three to six months; (4) cases of chronic mastitis in immediate danger of cancer present recognizable peculiarities, and (5) breast cancer should be treated by radical operation, with radium to the internal mammary glands and subsequent moderate prophylactic x-ray treatment.

The author states that the results of this experience offers encouragement to his belief that routine mastectomy for chronic mastitis can be safely rejected in favor of x-ray treatment with periodic examinations. It is apparent in the case histories that the sisters who received x-ray therapy systematically for mastitis did not require operation until a number of years had elapsed. Each of these cases of breast cancer was preceded for a long time by simple mastitis. This condition was kept in control in one case for 14 years before danger signals indicated surgery.

Q. B. CORAY, M.D.

Vertebral Metastasis from Carcinoma of the Breast Treated by Teleroentgentherapy. André Poulain. Bull. et mém. Soc. de Radiol. Méd. de France, **8,** 100, 101, February, 1938.

Twenty-three years after radical resection of the breast metastasis appeared in the vertebræ and pleura. Teleroentgentherapy, following the failure of local roentgen therapy, caused regression of the pleural thickening and exudate and some recalcification of the bone lesions with loss of pain and general improvement maintained (skin) for over a year. The patient was given 650 r in 26 treatments over a period of six weeks followed after two and four months by series totaling 300 r. Technic: 180 kv.p., 4 ma., 0.5 mm. Cu + 2 mm. Al, 150 cm. F.S. D., fields 40 × 40 cm. two anterior and two posterior.

S. R. BEATTY, M.D.

BRONCHOSCOPY

Phases of Bronchoscopy and Esophagoscopy of Importance in General Practice. Virgil J. Schwartz. Minnesota Med., **21,** 601–607, September, 1938.

Schwartz points out that whereas bronchoscopy and esophagoscopy once had for their principal utility the removal of foreign bodies, they now play important rôles in the diagnosis and treatment of primary carcinoma of the bronchi, malignancy of the esophagus, lung abscess, tuberculosis, diphtheria, bronchiectasis, and tracheal stenosis or displacement due to thyroid enlargement, mediastinal gland involvement, or aortic aneurysm. Also to be considered are cicatricial stenosis, scleroma, asthma, unexplained vomiting of blood or regurgitation of food, and atelectasis due to thick lung secretions.

Any unexplained interference with the function of swallowing, or of the stomach, an unexplained cough, dyspnea, hemoptysis, and expectoration call for appropriate investigation.

One patient with lung malignancy who had complained of symptoms for one year showed nothing but fluid in the base on roentgenographic study, and the diagnosis was made by bronchoscopy.

Cancer of the esophagus occurs in male patients most frequently in the middle third, next in the lower third, and least often in the upper third. In female patients, it is most frequent in the upper end.

Unexplained vomiting of blood may be due to an ulcer of the esophagus, which will often elude all forms of investigation but esophagoscopy.

Grasping a child by the feet and holding him upside down while trying to have him cough out a foreign body may have fatal results. In one of the author's cases in which this had been done, an acorn was found firmly wedged in the subglottic space and between the vocal cords. This acorn, previous to the manipulation employed by the child's parents, had been lodged apparently in one of the main bronchi.

In cases of diphtheria which appear terminal through obstruction to breathing, removal of the obstructing membrane by forceps or suction may result in recovery.

Bronchiectasis may frequently be prevented by repeated aspiration of residual pus in the lungs or bronchial tree—the result of an acute suppurative inflammation in this area.

An x-ray examination is advised in all foreign body cases, since there may be more than one foreign body. In closing, the author gives several cautions, among which are the following: never allow the age of the patient to influence diagnosis unduly; never leave thermometers in the mouths of unattended children; never practise "blind bouginage"; never diagnose "nervous" conditions in the esophagus without endoscopic examination; always repeat x-ray examination if a known foreign body cannot be found; always be prepared for tracheotomy; always be on guard for non-opaque foreign bodies in the chest.

PERCY J. DELANO, M.D.

CALCULI

Non-operative Management of Remaining Common Duct Stones. R. Russell Best and N. Frederick Hicken. Jour. Am. Med. Assn., **110,** 1257–1261, April 16, 1938.

The making of immediate cholangiograms at the operating table and delayed studies in all cases of common duct drainage or biliary fistula has added inestimably to the knowledge of the pathologic physiology of the extrahepatic biliary tract. The authors have used a 48 per cent solution of hippuran as a matter of routine with gratifying results. They found that delayed cholangiograms frequently revealed stones or foreign bodies such as blood clots, organized débris, or inspissated bile in common ducts, which were thoroughly explored by palpation, probing, scooping, irrigation, and suction at the time of operation.

The first problem is to provide a free exit at the lower end of the common duct through which the foreign elements may pass into the duodenum. The authors have observed, with the aid of cholangiograms, that magnesium sulfate on the duodenal side of the choledochal sphincter assists the contents of the common duct to pass more freely into the duodenum. They have also reported on the apparent soothing or relaxing effect of warm olive oil or iodized oil when applied to the choledochal side of the sphincter of Oddi through a T-tube or fistula. The second step in dislodging the foreign body is increasing the pressure behind it. This is easily accomplished by injecting saline solution, olive oil, or iodized oil through the drainage tube or fistula if the foreign body is below their level. If these smaller particles are lodged above the opening of the tube or fistula, they may be forced higher into the hepatic duct or into the larger biliary radicles within the liver. Again, after these higher stones are once dislodged, they may find their way down to the lower end of the common duct. It is also conceivable that increasing the flow of bile by stimulating its formation will augment the intraductal pressure. The flow of bile and the intraductal pressure are heightened after administration of either decholin or procholon, the commercial products of dehydrocholic acid. This added pressure is of greatest value when the foreign body is below the inlet of the T-tube, catheter, or fistula in the common duct, as it tends to force the impediment through the sphincter during some momentary period of relaxation.

The dehydrocholic acid products should be cautiously prescribed when there is any degree of jaundice with supposition of stone in the common duct. If the jaundice is marked, with acholic stools, great damage might be done to the liver, and dehydrocholic acid should definitely not be prescribed.

CHARLES G. SUTHERLAND, M.D.

A Large Calculus of the Gall Bladder with Suppuration. E. Binet and Dillenseger. Jour. de radiol. et d'électrol., **22,** 66, February, 1938.

The authors present the radiograph of an enormous gallstone (5 × 4 cm.). At operation, the gall bladder was found to be covered by adherent organs and to be the seat of a large abscess. The center of the stone itself was softened and necrotic.

S. R. BEATTY, M.D.

A Brief Review of 426 Consecutive Cases of Urinary Calculus. H. P. Winsbury-White. British Med. Jour., 1204, 1205, June 4, 1938.

The author makes the rather noteworthy statement that renal calculus was previously nothing compared with what it is to-day. The wave of urinary lithiasis began about 1924, and the increase has been in some localities as high as 1,000 per cent.

At present urinary calculi occur twice as often in males as in females and 79 per cent of the stones are in the upper tract. Chronic staphylococcic infections of the genitalia are predisposing factors. The great majority of ureteral calculi pass spontaneously. After instrumentation, observation should be made regularly by x-ray—either plain plate or intravenous urography.

It is abundantly clear that urinary lithiasis which manifests itself as a deficiency disease is vesical rather than renal. Fifty years ago this condition was common among poor children. Now it occurs mainly in men past 50 years of age.

Q. B. CORAY, M.D.

CANCER (DIAGNOSIS)

Results of Radiation Therapy in Carcinoma of the Hypopharynx. E. Bandhauer. Strahlentherapie, **62,** 705, 1938.

From 1932 to 1936, the author observed 92 cases of carcinoma of the hypopharynx. Eleven of these were in too advanced a stage to be treated, one was operated upon, 18 were treated by radium, 19 by a combination of x-rays and radium, and 43 by x-rays only. Fifty-nine cases could be treated completely and 40 of these were available for the follow-up. At the end of three years there were 20 per cent and at the end of five years there were 17 per cent alive and free from symptoms. The author did not use the original method of Coutard but a modified technic based on a method described by Holfelder.

ERNST A. POHLE, M.D., Ph.D.

Primary Carcinoma of the Lung. Max O. Klotz. Am. Jour. Med. Sci., **196,** 436–454, September, 1938.

As late as 1922, primary carcinoma of the lung was considered a rare disease. At the present time, its incidence is third among all malignancies.

Whether the increased frequency is actual or apparent is as yet undecided, nevertheless, this condition is seen more commonly now than formerly. The many factors responsible for the increase are the lengthened span of human life, the increased interest in the disease, the improved diagnostic procedures and equipment, the hope of carrying out successful operative treatment, and the marked improvement in the ability of the pathologist to recognize the disease.

All of the cases are probably of bronchial origin. Although a gross classification, disregarding cell type, is undesirable, it is usual to group the cases as the hilar infiltrating type, the nodular form, and the diffuse variety. The hilar infiltrating type, which forms the great majority of the cases, tends to form large masses about the lung root, with ulceration and stenosis of the bronchi, and massive involvement of the lymph nodes. The nodular form, which is uncommon, assumes a peripheral circumscribed appearance. The diffuse form, which is also infrequent, simulates a pneumonic consolidation or interstitial fibrosis.

The difficulty in classifying pulmonary cancers in relation to cell types arises from the fact that there is usually little resemblance between the tumor cells and the normal pulmonary structures. The bronchial lining cells probably give rise to these tumors.

About 40 per cent of the cases are those of an undifferentiated growth, while 30 per cent are of the cylindrical cell group and an equal number are of the epidermoid type. The first group consists of those showing oat cells and spindle cells, and were formerly called sarcomas. The cell of origin is impossible to determine. The cylindrical cell variety, forming the adenocarcinomas, probably arises from the bronchi, while the epidermoid type probably originates through metaplasia of bronchial epithelium.

The most satisfactory classification is that depicted by a "Y," the stem being the anaplastic form, and the two arms representing differentiation toward the cylindrical and the epidermoid cell types, the highest degree of differentiation.

Bronchial cancers are notorious for the frequency and the diffuse spread of their metastases—almost every organ having been recorded as a site for the secondary deposits. The highest incidence of extra-thoracic metastases occurs in the cervical lymph nodes, kidneys, adrenals, bones, brain, pancreas, and thyroid, in about that order. Samson contends that the adenocarcinomas show a special predilection for the central nervous system, kidneys, adrenals, and both lungs, probably due to hematogenous spread. The undifferentiated cell variety tends toward excessive lymphogenous spread, with invasion of the pancreas, liver, and spleen, while the epidermoid type involves chiefly the peribronchial lymph nodes.

Etiologically, these tumors are probably governed by the same laws that govern the development of carcinomas elsewhere. Climate appears to have little influence. The white race is predominantly affected. The peak incidence occurs between the ages of 50 and 60. It is relatively uncommon in females. Except for the miners of Schneeberg and Joachimstal, no industrial correlation has been found, although silicosis may be an important predisposing influence. Chronic irritation, particularly inflammation of the respiratory tract, is of the greatest possible significance. No hereditary factor for humans has been demonstrated as yet in carcinoma of the lung. Fischer-Wassels suggests the following sequence of events; hereditary predisposition, irritation, repair with excessive proliferation, and finally, malignancy.

BENJAMIN COPLEMAN, M.D.

Urinary Prolans in Cancer Cases. E. Harvey. Irish Jour. Med. Sci., **151,** 328–339, July, 1938.

With a broad discussion of the urinary prolans and their interrelations, together with their relation with carcinogenic hydrocarbons, the author opens his demonstration of the inability to correlate the urinary prolan concentration with the occurrence of cancer. The extensive investigation is of importance for its negative value.

JOHN MCANENY, M.D.

Primary Bronchogenic Carcinoma from the Pathologic and Radiologic Points of View. Walter L. Mattick and Eugene M. Burke. Jour. Am. Med. Assn., **109,** 2121–2124, Dec. 25, 1937.

In their series of 30,000 patients with 18,000 malignant growths there were 73 cases of carcinoma of the

bronchus (1 in 250). At postmortem examination this lesion was noted with half the frequency of carcinoma of the stomach. The greatest prevalence was noted between the ages of 40 and 70 years, the lesion being most common in the fifth decade.

Metastases were most frequent in the bones (38 per cent) and involvement of distant nodes was slightly less frequent (36 per cent). Extension to adjoining lobes or to the contralateral lung or regional nodes occurred with approximately the same frequency as distant metastases. These metastases or extensions were tabulated.

Only by the development to detect bronchial carcinoma, and the use of serial roentgenography in all cases in which the history is suggestive can the clinician or radiologist be led to the early recognition of the lesion.

The most common roentgen characteristics were atelectasis in the hilus, or central type, and tumor in the peripheral type, which was found in only 11 per cent of the cases of their series.

CHARLES G. SUTHERLAND, M.D.

Practical Ideas Concerning Cancerology Indispensable to the Practitioner. R. Reding. Bruxelles-méd., **18,** 933–943, May 22, 1938.

There is, among general practitioners, an unjustified pessimism concerning the prognosis of cases of cancer, an ignorance of the carcinogenic properties of certain commonly used medications, and of the etiologic importance of certain occupations and habits of living. Wider appreciation of the favorable results of present-day treatment of cancer would dispel much of this pessimism. The author has, in this paper, discussed briefly but rather completely the rôle of tar, petroleum derivatives, oestrin and folliculin, arsenic, and radio-active substances in the production of cancer. The employment of large doses of the vitamins is not without danger, in cancer cases particularly.

Chronic infection has a definite rôle in the etiology of cancer. Biopsy entails the danger of the spread of metastasis and should be done, if necessary, after preliminary irradiation, and the electric knife should be used. Immediate microscopic examination should be followed by the appropriate therapy. States of malnutrition undoubtedly favor the occurrence of neoplasms as does the absorption of indol from intestinal putrefaction. Tobacco is dangerous because of the hydrocarbons liberated in its combustion.

Occupational cancer occurs in those industries in which petroleum products, aniline dyes, arsenic potassium bichromate, and radio-active substances are employed.

S. R. BEATTY, M.D.

CANCER (THERAPY)

Roentgen Therapy. L. S. McAlister. Jour. Okla. St. Med. Assn., **31,** 161–164, May, 1938.

This is a discussion along general lines of the wide range of x-ray therapy, with mention of the various technics employed by the author and other roentgenologists. Excellent results are obtained in over 90 per cent of the cases of malignancy of the skin regardless of the quality of the ray used, provided that the total dose be administered within two weeks.

In addition to malignancy about 80 skin diseases and various acute and chronic infections are now benefited. Among the conditions mentioned are acute adenitis treated with 75 r daily, chronic adenitis 150 r, diphtheria carriers from 75 to 200 r, otitis media from 75 to 100 r, and erysipelas 75 r daily for from two to three days.

The question is raised whether or not good results in some inflammatory conditions are always the result of x-ray therapy, and whether sometimes a less radical form of treatment such as ultra-violet or sulfanilamide is not advisable for erysipelas.

JOHN M. MILES, M.D.

Cancer Campaign: Suggestions for Better Treatment of Malignant Growths. A. M. Begg. New Zealand Med. Jour., **37,** 147–153, June, 1938.

In radiotherapy we have a dual effect: (1) the direct lethal action of the rays on the cancer cells, and (2) the stimulating effect on the connective tissue cells which then wall off the remaining cancerous cells, finally obliterating them. Activity on the part of the fibrocytes is essential in the latter process. Too much radiation may destroy this activity by bringing about sclerosis of the fibrocytes and thereby rendering them useless in combating the cancer cells. On the other hand a small amount of radiation may not bring about the direct lethal action desired on the cancer cells. We wish to obtain the maximum of both effects.

To obtain the maximum lethal effect on the cancer cells, we should bring about a state of mitosis and remove as far as possible any sclerotic tissue surrounding the cells so as to re-establish a better vascular supply. To do this latter one may (1) inject fibrolysin; (2) apply Bier's suction glass daily to the site; (3) ionize the cancer with 2 per cent sodium chloride; (4) apply dry heat, or (5) use diathermy. To promote mitotic activity the writer advocates a preliminary starving of the patient for 24 hours, thus holding this activity in abeyance before treatment and the giving of a diet rich in liver and glucose, simultaneously with the beginning of treatment. The giving of x-rays for a prolonged time is advocated, but any sclerotic tissue formed should be removed by the methods mentioned above. After radiotherapy an active fibrocytic response may be induced by the injection of blood, the stimulation of lymphocytosis by the injection of olive oil or oleic acid, and the use of dry heat.

J. PAUL BENNETT, M.D.

Indications and Results of Treatment of Oto-rhino-laryngological Cancer by Radiations. L. Eloy. Bruxelles-méd., **18,** 455–458, Jan. 30, 1938.

The method of treatment employed in carcinoma of

the superior maxilla, tonsil, and larynx are briefly discussed. The author prefers surgery and radium in carcinoma of the antrum, surgery in adult tumors of the tonsils when metastases are not present, x-ray and radium in less adult lesions or those with glandular involvement. In carcinoma of the larynx, surgery is indicated except when the tumor involves the epiglottis, the pharynx, or has invaded the lymph glands. X-ray therapy is indicated in undifferentiated carcinoma of the ventricles.

S. R. BEATTY, M.D.

The Prevention and Control of Cancer: A Plan for Nation-wide Organization. J. W. Schereschewsky. Jour. of Med., **19,** 358–363, September, 1938.

This plan is based on the Bone Act establishing the National Cancer Institute which co-operates with the State Board of Health in the various States, these latter having a division of Cancer Control. Various localities in each state will have a center for diagnosing and treating malignancies. Each center will care for an area of about 50 miles in all directions.

The State Health Department will bind these various centers together, supply educational features to the laity and the medical profession, and provide diagnostic aid.

The probable cost to the whole nation for this program is estimated to be $10,000,000 per year.

J. B. MCANENY, M.D.

Early Results of Near Distance Radiation in Carcinoma of the Skin and Lip. A. Hrabovszky. Strahlentherapie, **62,** 691, 1938.

The author reports his experience with the treatment of 120 patients with carcinoma of the skin and lip. Seventy-nine cases had skin epitheliomas distributed over the following regions: frontal area, cheek, nose, ear lobe, eyelid, scalp, remaining skin of the face, body, and extremities. Sixty-two were in the early stage and 17 had indurated the subcutaneous tissue. In all cases the lesion was destroyed by the treatment and a primary cure was obtained. Of the 23 cases of cancer of the lip, 15 were early and eight advanced. All of these patients responded well and primary healing was obtained. A table is presented summarizing the results of seven different clinics, comprising a total of 619 cases of carcinoma of the skin and lip. In 96.2 per cent primary healing was secured. He concludes, therefore, that near distance x-radiation in the treatment of skin and lip cancer is as effective as radium, at least as far as immediate results are concerned.

ERNST A. POHLE, M.D., Ph.D.

THE COLON

Fundamentals in the Surgical Treatment of Colon Disorders. Lawrence M. Larson. Minnesota Med., **21,** 617–620, September, 1938.

Larson briefly reviews the anatomy and physiology of the colon, pointing out that there is a definite bilaterality in the two halves of the colon, right and left, and that the two halves behave differently in function and present different diagnostic problems.

The right half of the colon is thin-walled and absorptive; the left is thicker-walled and not absorptive.

Carcinoma in the right half of the colon is characterized by a marked and inexplicable anemia; beside this, there are usually only vague digestive symptoms.

Carcinoma of the left half of the colon is characterized only by obstructive symptoms in many cases, the general health remaining relatively unimpaired, and no anemia, or only a slight one, being noted. Other symptoms which may appear are flatulence and diarrhea.

In general, malignant lesions of the bowel are slow-growing, metastasize late, and good results may be expected from surgery if done at all early. Metastases were found in only a half, and liver metastases in only a third of 210 patients dying of bowel malignancies.

Roentgen-ray and proctoscopic methods should enable the diagnosis to be made in practically all cases.

The author discusses the surgical attack on various portions of the colon, together with pre-operative and post-operative care.

PERCY J. DELANO, M.D.

A Case of Genuine Invagination of the Colon. Bengt S. Holmgren. Acta Radiol., **19,** 135–142, May, 1938.

Cases of genuine colonic invagination on a tumor basis are rare. The number of such cases reported in the literature probably does not exceed 15 (author's case included).

The invagination was observed roentgenologically and confirmed operatively in a 62-year-old man who, for a period of about three months, had experienced almost continuous pain in the entire abdomen. The pain appeared immediately after meals and lasted about fifteen minutes. Examination of the stools was negative. Palpation of the abdomen revealed neither tenderness nor tumor masses. X-ray examination after barium enema during an acute attack of pain showed an invagination of the ascending colon near the hepatic flexure combined with a filling defect, apparently due to tumor, distal to the valvula Bauhini. In addition, sigmoiditis with diverticulosis was observed. Four days after the x-ray examination an ileo-ceco-colic resection and a latero-lateral ileotransversostomy were performed. The post-operative pathological tumor diagnosis was adenocarcinoma. The patient died nine days after the operation of paralytic ileus and chronic myocarditis.

The author stresses the necessity of x-ray examination during the attacks of pain as well as during, and after, the evacuation of the barium enema.

ERNST A. SCHMIDT, M.D.

Prognosis of Diverticulitis and Diverticulosis of the Colon. Philip W. Brown and David M. Marcley. Jour. Am. Med. Assn., **109,** 1328–1333, Oct. 23, 1937.

The incidence of diverticula of the colon is approxi-

mately 5.6 to 7 per cent. The rate of diverticulitis to diverticulosis is one to six or eight.

Follow-up data were obtained in 86 per cent of a series of 596 cases of diverticulosis or diverticulitis. In a few cases of simple diverticulitis, complications may develop and require surgical treatment. Medical treatment of diverticulitis consists of rest, the application of heat, regulation of the diet, and the oral administration of olive oil. In 63 per cent of cases this type of treatment was successful. Many of the patients that showed results only fair or poor were able to live in comparative comfort. The relationship between diverticulitis and carcinoma of the colon probably is incidental rather than actual.

CHARLES G. SUTHERLAND, M.D.

Causes and Results of Colospasms. L. Gleize-Rambal. Bull. et mém. Soc. de Radiol. Méd. de France, **26,** 82–85, January, 1938.

The causes of colospasm are varied but the author believes that a frequently unregarded factor is the presence of an argentaffin tumor of the intestinal tract, usually located in the appendix. These tumors contain tissue similar to the adrenal and may cause symptoms by secretion of an excess of adrenaline. Removal of an appendix which is the site of such a tumor may relieve the symptoms.

Spasm of the colon results in delay favoring fermentation with production of oxalic acid as one of the chief consequences. Absorption of oxalic acid may produce hypocalcemia, vagotonia hypotension, and hypocalcemic spasmophilia.

A syndrome of alternating delay and acceleration of the passage of material through the colon precedes the appearance of true colospasm which is diagnosed by its constant appearance in several examinations.

The determination of the amount of oxalic acid in the blood, careful study of liver function, and repeated studies of the colon are essential. Physiotherapeutic methods are often valuable in the treatment of syndrome of colospasm.

S. R. BEATTY, M.D.

DENTAL INFECTION

The Diagnosis of Focal (Dental) Infection, Especially by Means of the Roentgenogram. Wolfgang Praeger. München. med. Wchnschr., **85,** 1076–1078, July 15, 1938.

The author discusses some of the causes of error in diagnosing dental abscess. The focus may be too small to see; it may be obscured by irregularity of projection of some of the roots, or it may be lost by divergent projection of the beam. Of this last, some examples are cited. The mental foramen is a cause of error.

The question of whether or not a focus is sharply limited may be determined. The appearance depends, however, on a large number of other factors as well. Negative findings are not necessarily conclusive of absence of infection. Pulp death may also be diagnosed by roentgen examination.

From a therapeutic standpoint, the prevention and care of caries, especially in children, the treatment of caries which have involved the pulp cavity, and the care of infected teeth are important.

LEWIS G. JACOBS, M.D.

THE DUODENUM

Diverticulum of the Duodenum. Digby Wheeler. Canad. Med. Assn. Jour., **39,** 214–219, September, 1938.

The author suggests a division of duodenal diverticula into primary and secondary. Primary are those found in the second, third, and fourth portions of the duodenum. They are probably congenital and are most frequently found on the inside of the duodenal loop and are therefore in relationship to the head of the pancreas. An exception is a case, presented by the author, of a large traumatic diverticulum of the lateral side of the second portion of the duodenum. Primary diverticula are often multiple and seen after the fifth decade. The wall is formed by the mucosal and submucosal coats. Secondary diverticula are the result of chronic ulcer and occur only in the first portion of the duodenum. All the coats of the intestine form the wall.

There are no pathognomonic signs or symptoms and the only method of diagnosis is by the barium meal. In an x-ray examination the following points must be noted: (1) size and shape; (2) situation; (3) dimensions and position of orifice; (4) mobility; (5) length of time the barium is retained, and (6) relationship of the shadow to any point of tenderness.

If a diverticulum is the cause of the patient's trouble it is customary to try medicinal treatment before any operative procedure is undertaken. At operation difficulty is sometimes experienced in locating a pouch that has been previously located by x-ray. This occurs especially when the pouch is embedded in the pancreas or is lying dorsal to it.

M. L. CONNELLY, M.D.

Unusual Case of Invagination of the Pylorus into the Duodenum. Liborio Galifi. Radiol. Med., **25,** 454–466, May, 1938.

The author reports a case of recurrent intussusception of the duodenum. The clinical history is of especial interest because the location of the pain, melena, and the relief of the pain by alkalies were very suggestive of ulcer.

Roentgenological examination, however, failed to confirm the diagnosis. In the erect position, examination of the cap was very difficult, but a certain flaccidity of this portion of the intestine with a tendency for the bulb to hide within the gastric lumen was noticed. In the roentgenogram the deformity was a dome-like, transparent shadow, adjacent to the pyloric end of the stomach, capped by the triangular (caput-like) shadow of the duodenal bulb. In the prone position the de-

formity assumed a crater-like shape through which the mucosa showed as transverse folds. This crater shadow was circumscribed by an opaque shadow. The appendix was curved, beaded, and tender.

The author discusses at length the causes of intestinal invagination, paying particular attention to the changes in intestinal tone manifested by contraction or dilatation brought about as a result of either toxic or reflex action. Of the latter causes, cholecystitis and appendicitis are especially important. The nerve impulse is transmitted by way of the spinal nerve roots. Attention is called to the greater frequency of intussusception among children than among adults.

In a case presenting distinct signs of appendicitis, these could be held responsible for the invagination and if, after an appendectomy, the condition did not recur, the presumption would be greatly confirmed, but should the patient refuse operation, the assumption would remain theoretical.

A. MAYORAL, M.D.

DYSPEPSIA

Incidence and Causes of Chronic Dyspepsia at Various Ages: An Analysis of 4,223 Cases. Andrew B. Rivers and Antonio E. Mendes Ferreira. Jour. Am. Med. Assn., **110,** 2132–2136, June 25, 1938.

Ten thousand consecutive histories of patients aged 15 or older were scrutinized to obtain material for this study. A division of histories according to sex was then made and the causes of dyspepsia for each sex. The authors then proceeded to study the causes of dyspepsia in patients who presented themselves primarily because of this condition. The histories were finally divided into three groups: the first of patients from 15 to 24, the second of patients from 25 to 39, and the third of patients of 40 or older.

Their findings were charted according to the incidence of dyspepsia in 10,000 consecutive cases; the 12 most common causes of dyspepsia in order of frequency; the ten most frequent causes of dyspepsia according to sex, and the causes of dyspepsia in 2,045 cases in which the primary complaint was dyspepsia. These charts were repeated to show the causes of dyspepsia in males and females from 15 to 24 with a primary complaint of dyspepsia, in men and women from 25 to 39, and in men and women of 40 or older.

Symptoms of chronic dyspepsia must always be evaluated carefully. All available methods of diagnosis should be utilized to obtain exact knowledge regarding its underlying cause. This is particularly important if the patient has reached the age of 40, when dyspepsia must be considered of grave significance until it is proved otherwise.

CHARLES G. SUTHERLAND, M.D.

DYSPHAGIA

Hysterical Dysphagia: Report of a Case. Herbert W. Schmidt. Minnesota Med., **21,** 34, January, 1938.

The author lists the lesions, benign and malignant, which may cause dysphagia. Hysterical dysphagia was so named in 1914 by H. S. Plummer.

This syndrome is characterized by a difficulty in swallowing and is associated with a hypochromic anemia. It occurs among women and there is no definite evidence of organic obstruction in the esophagus. The patients complain of a dysphagia which begins suddenly, and usually is as pronounced at the onset as at any time in its course. The patients have the greatest difficulty in swallowing solid foods; they say that solid foods will not go past the cricopharyngeus muscle. This difficulty may become extreme. In the case reported, the patient said she would strain the juice from strawberries to get rid of the seeds, and strain the curds from buttermilk to get rid of the curds before ingestion.

Many such patients have false teeth, and fissures at the corners of their mouths. There frequently is a glossitis which is associated with atrophy of the lingual papillæ, which gives the tongue a red, glazed appearance which resembles the type seen in pernicious anemia. In about a third of the cases the spleen is palpable. Most of the patients have an achlorhydria.

It is felt that the anemic changes are secondary to the prolonged dietary restrictions.

The patient whose case was reported was treated at the Mayo Clinic by the passage of a No. 41 French sound, with complete relief of symptoms. The anemia cleared up with food, and iron, and ammonium citrate.

PERCY JOSEPH DELANO, M.D.

THE EAR

Some Observations on Petrous Tip Suppuration: Report of Three Cases. D. E. S. Wishart. Canad. Med. Assn. Jour., **39,** 50–56, July, 1938.

Although "petrositis" has been included in the indices of works on surgery of the ear only for the last seven years, there are scattered references in the literature dating back to 1893. Gradenigo, in 1904, described the classical picture of the condition as otitis media, pain, usually with temporoparietal distribution, and diplopia due to its involvement of the abducens nerve. Eagleta, in 1929, performed the first deliberate operation for this condition. Shortly after, there appeared Kopetzky and Almour's authoritative text, "The Suppuration of the Petrous Pyramid."

The author describes three types of infection of the petrous bone, illustrating each with an extensive case history: (1) abscess of the neck which ruptured upward through the tip of the petrous bone (surgery, recovery); (2) classical picture of petrositis as outlined by Kopetzky and Almour (extensive surgery, recovery), and (3) wide-spread empyema of the tip of the petrous bone (surgery, death, postmortem findings).

There is a careful anatomical description giving the opposing views as to the distribution of marrow, cavities and air spaces, and their importance in surgery.

In 3,425 consecutive autopsies at the Hospital for Sick Children in Toronto there was but one case of suppuration of the petrous tip. From the Royal Infirm-

ary in Edinburgh come results obtained in 1,279 cases of mastoiditis. Only one case of meningitis following apicitis was reported. This proportion is probably far too low as many unrecognized cases undoubtedly recovered following mastoid operations.

Experience has shown that Gradenigo's syndrome is not synonymous with petrositis and that the diagnosis rests at least in part on roentgen-ray examination. When x-ray study is warranted in otitis media or mastoiditis a special plate should be taken of the petrous bone. In some cases the x-ray evidence seems to have been the factor which decided operation. Coates, *et al.*, have shown by x-ray that suppuration in the petrous pyramid is not rare and that spontaneous recovery is the rule, thus proving that the conservatism of the past has not been too faulty.

M. L. CONNELLY, M.D.

THE ESOPHAGUS

Esophageal Hiatus Hernia, with Special Reference to its X-ray Diagnosis. David Eisen. Canad. Med. Assn. Jour., **39,** 207–213, September, 1938.

The diagnosis of esophageal hiatus hernia is dependent almost entirely on the use of the x-ray. It is not a rare condition. The author's 33 cases were seen in the course of routine gastro-intestinal x-ray examination of 1,138 patients.

Anatomical classifications are as follows:

1. *Short Esophagus Type.*—Between the distal end of the esophagus and the diaphragm is a dilatation filled by fundal rugæ which is never reduced by standing. These are all congenital.

2. *Para-esophageal.*—In this type the barium can be seen to run down the esophagus below the diaphragm. As the stomach fills and distends barium appears around or to one side of the esophagus above the diaphragm. Pressure of this herniated mass against the lower end of the esophagus may obstruct it, thereby causing slight dilatation and increased peristalsis proximal to the obstruction.

3. *Gastro-esophageal Type.*—The cardio-esophageal junction is above the diaphragm. The esophagus is usually relaxed and tortuous. Standing results in spontaneous reduction and straightening of the esophagus if no adhesions are present. Types 2 and 3 are acquired.

Symptoms depend somewhat upon the size of the hernia. Small ones (two or three cm.) are probably symptomless. When present, symptoms may be intermittent and are rarely progressive. Characteristically, symptoms are more severe after a large meal and on reclining. Conversely, they are relieved by standing, belching, or vomiting. A most common symptom is vague distress, immediately after the intake of food, located substernally or in the epigastrium. This dull pain may radiate to the subscapular region, thus simulating chronic cholecystitis. Heart-burn or postprandial distress occur occasionally, thus mimicing peptic ulcer. Thoracic symptoms include fullness after eating, dyspnea, palpitation, anginoid pain with typical cardiac radiation, and dysphagia after, rather than during, a meal. The proper evaluation of symptoms is important. The failure of a given gastro-intestinal syndrome to respond to its usual treatment should make one suspect hiatus hernia. On the other hand, the finding of even a large hiatus hernia should not terminate the search for other lesions as they are frequently incidental to the primary cause.

Roentgen examination is the essential means of diagnosis. In the standing position, before the administration of barium, a stomach bubble can occasionally be seen above the diaphragm. After the barium meal the patient should be examined in all positions since no one position is satisfactory in visualizing the hernia in all cases. The author has never visualized a hernia in the Trendelenburg position that could not be seen in the prone position. In the author's experience the right anterior oblique has been the most useful position. Aimed roentgenography is a distinct advantage as the stomach may herniate momentarily and reduce spontaneously, or the empty herniated portion may be closed off by temporary spasm. A series of eight or ten films taken after a hernia has been demonstrated by fluoroscopy may fail to show the defect. Indeed, subsequent fluoroscopic examination may be negative.

Medical treatment is largely symptomatic. Surgery is indicated in cases of sudden obstruction and in all hernias involving the colon as these may be considered as cases of potential obstruction.

Esophageal hiatus hernia is not uncommon, gives rise to varied symptoms, and is diagnosed almost exclusively by roentgen examination.

M. L. CONNELLY, M.D.

Mega-esophagus and Narrowing of the Terminal Portion of the Esophagus. C. Bocca. Jour. de méd. de Lyon, **18,** 463–467, Aug. 20, 1937.

Certain cases of mega-esophagus are not of congenital origin but follow inflammatory narrowing subsequent to spasm and stasis with infection. An enormous dilatation of the esophagus may result. The clinical picture with vomiting and thoracic pain prominent and loss of weight to cachexia, is such that malignancy is simulated.

S. R. BEATTY, M.D.

Studies Regarding Technic and Methods in Radiation Therapy of Carcinoma of the Esophagus. A. Adam. Strahlentherapie, **63,** 316, 1938.

This interesting contribution to the problem of radiation therapy in carcinoma of the esophagus presents a critical analysis of our present possibilities in this particular field based on a thorough study of the author's own clinical material. While the article does not lend itself well to abstracting without going into great detail (70 pages), one of the conclusions reached by the author is quoted: "It seems most important to apply a sufficient amount of radiant energy to the tumor without irradiating excessively the surrounding

normal tissue. With ordinary 200 kv. x-rays, seven to ten fields are required to do efficient therapy. This great number of areas will, however, lead to an undesirable exposure of normal tissues. Supervoltage permits the administration of sufficiently high doses without this shortcoming connected with the use of 200 kv. x-rays and should, therefore, be given a thorough trial in the treatment of carcinoma of the esophagus."

ERNST A. POHLE, M.D., Ph.D.

FRACTURES

Two-plane Direction and Range Finder for Nailing Fractures of the Neck of the Femur. Gilson C. Engel and Hans May. Jour. Am. Med. Assn., **110,** 1828, 1829, May 28, 1938.

Because of the extreme difficulty in getting the Kirschner wire in proper position to feed the Smith-Peterson nail on it, in nailing fractures of the neck of the femur and in determining the length of the femoral neck, the authors' interest was stimulated to find a better method. With their direction finder (illustrated) the difficulty in getting the position of the fragments and the wire in good alignment in the anteroposterior and lateral plane was entirely eliminated.

The instrument can be used as a direction and range finder if the Smith-Peterson nail, the Henderson lag screw, or the Moore nails are used for internal fixation of intracapsular fractures of the neck of the femur.

Knowing the actual length of the direction finder, which is 9 cm., they are able to find the actual length of the femur by a simple ratio. By adding the actual length of the neck of the femur to the actual length of the direction finder, they get the length, which they mark on the Kirschner wire. The actual length of the neck of the femur minus one-half inch, allowing for impaction of fragments, gives the length of the nail to be used.

CHARLES G. SUTHERLAND, M.D.

Fracture of Neck of Scapula. Max R. Charlton. Northwest Med., **37,** 18–20, January, 1938.

The author calls attention to the scant literature relating to these types of fracture in current textbooks on the subject. He discusses pathology, etiology, diagnosis, and treatment, and reports a case of fracture of the necks of both scapulæ.

A. MAYORAL, M.D.

Some Experimental Studies of the Action of Short Waves on the Process of Healing of Fractures. E. Fischel. Archivio di Radiologia, **16,** 447–454, September–December, 1937.

The author treated fractures of the thigh in 18 rabbits with 6-meter short waves applied both locally and to the whole body. He found that strong local irradiation leads to early disappearance of the nucleus of ossification in the callus and that mild irradiation produced no noteworthy changes differing from the controls, but neither type of radiation was followed by normal callus formation. Total irradiation induced the formation of callus. With mild irradiation the nuclei of calcification appears early, but the callus never was normal.

E. T. LEDDY, M.D.

Pathologic Fractures. Ralph K. Ghormley, Charles G. Sutherland, and George A. Pollock. Jour. Am. Med. Assn., **109,** 2111–2115, Dec. 25, 1937.

For the purposes of review these were divided into three groups: (1) pathologic fractures attributable to metastasis from malignant lesions; (2) pathologic fractures attributable to primary malignant lesions of bone, and (3) pathologic fractures attributable to other causes, such as benign tumors and non-neoplastic diseases of bone.

Occasionally a true pathologic fracture may occur in a tuberculous vertebra or in other bones, but such a condition is rare.

The fractures occurring with metastatic malignant lesions were tabulated to indicate the comparative frequency of the incidence of fracture in the different forms of metastasis. Pathologic fractures were comparatively frequent in osteogenic sarcoma, myeloma, and Ewing's tumor.

In the benign types of lesion causing pathologic fracture the preponderance of those associated with marked decalcification of the bone was noteworthy, senile osteoporosis leading the list as a causative factor.

CHARLES G. SUTHERLAND, M.D.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

Duodenal Anomaly. H. Tillier. Bull. et Mém. de Radiol. Méd. de France, **26,** 191, 192, March, 1938.

The author presents a case of an anomalous duodenum characterized by elongation and mobility of the second part of the duodenum which forms a complete loop; the presence of a diverticulum of the inferior part of the second, and by the lack of the fourth part of the duodenum, the angle of Trietz lying at the level of the horizontal portion of the duodenum.

S. R. BEATTY, M.D.

Solitary Diverticulitis of the Cecum. W. N. Graves. Minnesota Med., **21,** 615–617, September, 1938.

The author confines his discussion to solitary diverticulum of the cecum, which, when inflamed, may be confused at operation with the appendix. He reports a case in which the diagnosis of acute gangrenous appendicitis had been made. The basis of symptoms was such an inflamed diverticulum, which was removed. Subsequent roentgenologic study of the colon revealed no other diverticulum.

He summarizes the 25 reported cases: thirteen were in females averaging 44 years of age, the most common age incidence in this group being from 45 to 60 years; twelve were in males averaging 38 years of age. The youngest patient was three; the oldest, 69.

All patients recovered, except one in whom the preoperative diagnosis of carcinoma of the cecum was made and a colon resection done.

The theory offered for the development of this anomaly is that of a residual appendix, which precedes the true appendix embryologically, and which in these cases allows of a certain persistence and development rather than the usual disappearance.

PERCY J. DELANO, M.D.

HEART AND VASCULAR SYSTEM

Relief of Anginoid Pain Following Removal of Intrathoracic Non-toxic Nodular Goiter. Joseph Edeiken and Edward Rose. Am. Jour. Med. Sci., **196,** 395–400, September, 1938.

The various relationships between the thyroid gland and cardiac disorders include: (*a*) the effect of total ablation of the normal thyroid gland on congestive failure and angina pectoris; (*b*) the relation of thyrotoxicosis to congestive failure, arrhythmias, and angina pectoris, and (*c*) the relation of non-toxic goiter to certain cardiac abnormalities.

Attention is directed toward the relationship between substernal non-toxic goiter and anginoid pain with the report of a case of a white woman, 45 years of age, with a large intrathoracic goiter in close proximity to the aortic arch, who experienced frequent and severe attacks of pain in the left thorax and shoulder. Laboratory studies showed upright T waves in the precordial electrocardiographic leads, hypercholesterolemia, and a normal basal metabolic rate. Subtotal thyroidectomy was followed, at first, by a marked reduction in the number and severity of the anginoid attacks, and later by their disappearance. The electrocardiographic tracings returned to normal.

BENJAMIN COPLEMAN, M.D.

The Size, Variability, and Correlation of the Heart at Puberty. Gualtiero Marzocchi. Radiol. Med., **25,** 436–453, May, 1938.

The author studied the variability of, and correlation between, the size of the heart and width of the chest wall in both sexes. The work is based on the study of 639 ortho-diagrams of the hearts of patients between the ages of 11 and 17, 339 of whom were males.

The author found the dimensions of the male heart to be larger than those of the female. When computed against the body width the male heart was again found to be proportionately larger than the female, this relative difference being maintained even during that period of growth in which the female body assumes greater proportion than the male. It appears, therefore, that the male heart is larger than the female heart throughout life. The author believes that there is a "certain amount of hypoplasia in the female heart." On these facts the criterion of the greater resistance and greater muscular output of the male heart can be based.

A. MAYORAL, M.D.

Isolated Calcified Aortic Stenosis. William F. Friedewald and Agnew R. Ewing. Am. Jour. Med. Sci., **196,** 400–407, September, 1938.

Only three of 72 cases of isolated calcified aortic stenosis, the average age being 60 years, found among 22,000 autopsies, gave a history of rheumatic fever. The vast majority had a normal or decreased pulse pressure.

Clinically, the typical case is that of a male over 50 years of age, with the usual history of cardiac decompensation, a to-and-fro murmur over the aortic area, an absent second sound or a thrill in this region, a normal or decreased pulse pressure, and a negative blood serology. There may be few cardiac symptoms, however. Most of these cases terminate in cardiac failure, although sudden death may occur.

A valvulitis results from rheumatic fever, with the formation of dense scar tissue in the healing stages. Later, calcification may occur, and even true bone be formed. The etiology is rheumatic if there is a coexisting mitral valvulitis or involvement of the chordæ tendineæ, or if the aortic valvulitis exists alone, if there is fibrosis and thickening of the cusp edges. White states that when the entire valve is calcified with retraction and marked stenosis, arteriosclerosis and an old infection with superimposed calcification are probably combined. Rheumatic aortic stenosis calcifies relatively early, and only a few cases are seen at autopsy with a purely fibrotic lesion. It is interesting to note that rheumatic mitral stenosis is calcified unusually, and then only in old individuals.

If the valve shows a sclerotic base with scattered calcified nodules over the leaflet, and the remainder is thin and not fibrosed, the etiology is probably arteriosclerotic. Arteriosclerotic involvement of the mitral valve affects the base of the valve, leaving the edges free.

It appears that no one etiologic factor is responsible for all the cases of aortic valve calcification. Additional involvement of the mitral valve indicates a rheumatic etiology, while isolated aortic stenosis suggests an arteriosclerotic etiology. The etiology in far advanced cases is impossible to determine.

The clinical diagnosis is not difficult if the condition is kept in mind. A fluoroscopic and roentgenographic examination is a valuable aid. Fluoroscopically, the calcifications characteristically move with each heart beat.

In the differential diagnosis, the high incidence of a positive serology in syphilitic aortitis, and the characteristic signs of aortic stenosis, should be kept in mind.

BENJAMIN COPLEMAN, M.D.

INFLAMMATION

Fundamental Principles of Roentgen Therapy of Inflammatory Conditions. W. von Weiser. Jour. de radiol. et d'électrol., **22,** 209–214, May, 1938.

There are two extremes of x-ray treatment: very small doses and heavy doses. X-rays have no bac-

teriolytic effect either in pus or blood serum. Therefore, the results of treatment do not depend on the sensitivity of the bacteria; rather, the varying sensitivity of different patients explains why different doses have the same effect. There are two methods of treatment: (1) a heavy dose to eliminate the function of the affected organ, and (2) a small dose directed at the inflammation itself.

The reaction of inflammatory tissue to x-rays depends on:

(1) Acute inflammation is accompanied by polymorphonuclear leukocytes which act like young cells and are highly radiosensitive.
(2) Chronic inflammation is accompanied by lymphocytes which are less radiosensitive. When connective tissue develops, the dose must be increased because it is only slightly sensitive to x-rays.
(3) The abundance of blood vessels in the infected part is a factor since the greater the vascularity, the greater the sensitivity to x-rays.
(4) The innervation of the affected part is another factor because the vegetative nervous system is very radiosensitive.

In conclusion, we have the following methods of treatment:

(1) Direct attack on the inflammation by small doses.
(2) Indirect attack by large doses which exclude the function of the organ.
(3) Direct influence resulting from the local reaction and another resulting from the systemic reaction.
(4) Between the local and systemic reactions there is a reciprocal reaction.
(5) Dosage and interval between treatments should be adapted to each specific case.
(6) X-rays have accumulative effect and an unfavorable reaction or none at all may result if timing is not right.
(7) If small doses do not produce the desired effect increase the dose.

J. SAGEL, M.D.

THE JOINTS

The Technic of Air Injection of the Joints. Robert Meyer-Wildisen. Schweiz. med. Wchnschr., **68**, 991, Aug. 20, 1938.

This brief note describes pneumoradiography of the joints. The author advises injection of from 1.5 to 2.5 c.c. of abrodil (skiodan) plus enough carbon dioxide to fill the joint. In bloody or serous effusions satisfactory results may be obtained without abrodil. The internal structure of the joint and the presence and location of joint mice and foreign bodies can be demonstrated invariably.

LEWIS G. JACOBS, M.D.

Conditions Responsible for the Radiographic Visualization of the "True Joint Fissure." W. Magnusson. Acta Radiol., **18**, 733–741, October, 1937.

In 1932, Dittmar reported the possibility of visualizing, without contrast medium, the joint fissure proper and the medial meniscus both in pathologic knee joints of adults and normal knee joints of children. These observations were later confirmed for a number of joints by various authors. Magnusson shows that this phenomenon which appears as a well demarcated dark fissure can be produced experimentally in children either by over-extension of the joint or by traction. In addition, he has observed such fissures in the intervertebral disks in cases of spondylitis deformans, and in the pubic symphysis in pregnancy. With Fick and his collaborators, Magnusson assumes that the phenomenon is probably due to the development of gas in the joint. All investigators agree that the observation is of more theoretical than practical significance.

ERNST A. SCHMIDT, M.D.